Cibola Breadstuff:

Foodways and Social Transformation in the Cibola Region A.D. 1150-1400

by

Sarah E. Oas

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved March 2019 by the
Graduate Supervisory Committee:

Michelle Hegmon, Co-Chair
Keith Kintigh, Co-Chair
Christopher Morehart
Matthew Peeples

ARIZONA STATE UNIVERSITY

May 2019

ABSTRACT

Foodways in societies at every social scale are linked in complex ways to processes of social change. This dissertation explores the interrelationship between foodways and processes of rapid social transformation. Drawing on a wide range of archaeological and ethnographic data from the Cibola region, I examine the role of foodways in processes of population aggregation and community formation and address how changes in the scale and diversity of social life interacted with the scale and organization of food production and consumption practices. To address the interrelationships between foodways and social transformations, I employ a conceptual framework focused on two social dimensions of food: cuisine and commensality. This study comparatively examines cuisine and commensality through time by investigating a range of interrelated food activities including: food production, storage, preparation, cooking, consumption and discard.

While settlement patterns and other more obvious manifestations of aggregation have been studied frequently, by examining foodways during periods of aggregation and social reorganization this study provides new insights into the micro-scalar processes of social transformation, cuisine change, and economic intensification associated with increases in settlement size, density, and social diversity. I document how food production and preparation intensified in conjunction with increases in the size of settlements and the scale of communal commensal events. I argue that foodways were a critical aspect of the social work of establishing and maintaining large, dense communities in the 13th and 14th centuries. At the same time, widespread changes in commensal practices placed a larger burden on household surplus and labor and women were likely the most affected as maize flatbreads and other foods made with finely ground flour were adopted and became central to cuisine. As such, this study provides insights into how rapid social transformations in the late 13th and 14th centuries were experienced differently by individuals, particularly along gendered lines. Studies of foodways, and specifically the social dimensions of food, offer a promising and often underutilized source of

information about past processes of population aggregation, social integration, and transformations in the political economies of small-scale societies the past.

ACKNOWLEDGEMENTS

First and foremost, I wish to thank my incredible committee: Michelle Hegmon, Keith Kintigh, Christopher Morehart, and Matt Peeples for many years of mentorship, support, friendship, and inspiration. Other important figures in my academic journey at Arizona State University include Peggy and Ben Nelson, Kate Spielmann, and the whole team involved with the Long-Term Vulnerability and Transformation Project (LTVTP) who first encouraged me towards working and thinking about food data at regional scales. I would also like to thank Karen Adams, Catherine D'Andrea at Simon Fraser University, Amanda Logan at Northwestern University, and Lisa Young and Laura Motta at the University of Michigan for their past mentorship, friendship, and continued support in my studies of anthropology, archaeology, and paleoethnobotany.

This work relied on an immense number of archaeological collections and legacy data and the support and assistance of many individuals and institutions: Arelyn Simon who facilitated access to numerous collections at the Archaeological Research Institute at Arizona State University, Jamie Kelley, Jamie Lewis, and Armand Esai at the Chicago Field Museum, Anthony Thibodeau at the Museum of Northern Arizona, Dean Saitta at the University of Denver Museum of Anthropology, Julia Clifton and C. L. Kieffer at the Laboratory of Anthropology and the Archaeological Repository at the Center for New Mexico, and Lynette Cross at the Casa Malpais Museum.

I would also like to thank the many individuals who generously shared data and manuscripts used in this study: Gregson Schachner, Andrew Duff, Barbara Mills, Mollie Toll, Karen Adams, Jon Sandor, Karen Schollmeyer, and Jenny Adams. I also thank the several students at Arizona State University who contributed to the collection of ceramic, groundstone, and paleoethnobotanical data through the undergraduate research apprenticeship program.

This project would not have emerged as it did without the support of many individuals at Zuni Pueblo. I thank Governor Val Panteah Sr. and the Zuni Tribal Council for permission to pursue the Zuni Foodways Project. To Jim Enote, I express special thanks for many years of enriching conversation, collaboration, advice, and quality hands-on experience at your field and with the wonderful farming community at *K'ya'na*. I am deeply grateful for the archival support given to me by Cordelia Hooee, and for the to the time and expertise extended to me by many cooks, gardeners, and farmers especially: Loreneita Walela, Curtis Quam, Patterson Peynetsa, Rex Chimoni, and Richard Sanchez. To Enric Tsalate, Ryan Aguilar, and the whole Ancestral Lands Zuni Southwest Conservation Core crew I am immensely grateful for your hospitality, humor, and remarkable passion for learning and sharing traditional Zuni food knowledge within your community. *Elahkwa*!

This project received financial support from several institutions. Collections analysis, travel, and consultation and dissemination with cultural experts on farming and cooking at Zuni Pueblo was funded primarily through a National Science Dissertation Improvement Grant (NSF 15-554). Additional costs relating to travel and collections analysis were supplemented by a Graduate Research Grant from the School of Human Evolution and Social Change and through a Graduate and Professional Student Association Research Grant at Arizona State University. I also received support from an Arizona Archaeological and Historical Society Research Grant. The Cibola macrobotanical database used in this study was initially compiled and curated digitally as part of the National Science Foundation Biocomplexity program funded Long Term Vulnerability and Transformation Project at Arizona State University (BCS-0508001; PI: Margaret Nelson).

I express a special thanks to Carla Van West and Roger Irwin for their friendship and generous hospitality in sharing their beautiful cabin in Ramah with me while I worked at Zuni Pueblo. To Brenda Shears, I also convey my thanks for your hospitality and lively conversation during my stay at your lovely home in Santa Fe.

To my friends and colleagues: April Kamp-Whitaker, Christopher Schwartz, Sarah Klassen, Nick Gauthier, Samantha Fladd, Kate Bishop, Caitlin Wichlacz, Katherine Dungan, Kyle Bocinsky, Ben Bellorado, Kellam Throgmorton, Reuven Sinensky, and so many others that I do not possibly have the space here to name. Words cannot express my thanks or the importance of all your support, brilliance, and friendship over the years.

To my family, Barbara and Peter Oas, Rebecca Oas, Marty Oas and Alex Oas-Thorn, as well as Deborah Burrell, Jennifer, Gene, and of course Joakim Marlow, you have all been so amazingly supportive. Thank you all for many years of understanding, encouragement, humor, good cooking, and love. To my “family” inside and outside of *dōjōs* in Tempe, the wonderful team at the Arizona State University Center for the Study of Race and Democracy, and especially to James, Mollie, Ed, Emily, and Rita Wermers I am deeply grateful for the opportunity to learn, laugh, and grow alongside you for these past few years. Finally, I thank Chris, for love, encouragement, and humor with this *mendokusai* archaeology thing. Without you this journey would not have been nearly as wonderful!

TABLE OF CONTENTS

Page

LIST OF TABLES xiii

LIST OF FIGURES xvi

CHAPTER

1 THE INFLUENCE OF OUR BREADSTUFF 1

The Case Study 6

Organization of Dissertation 10

2 FOOD AND SOCIAL CHANGE 13

Foodways in Mind, Body, and Society 15

Cuisine 17

Essential Ingredients 18

The Conservative Nature of Cuisine 22

Continuity and Change in Cuisine 26

The Social Value of Food 28

Summary 32

Commensality 34

Setting the Table 34

Linking Domestic and Political Economies 35

Power and Politics 38

Food Gifts, Commodities, and Capital 39

Meals-As-Events, Meals-as-Experiences 41

Summary 45

Foodways and Transformations in the Scale of Social Life 45

The Opportunities and Challenges of Scaling Up 47

Summary 53

Chapter Summary 53

3 SOCIAL TRANSFORMATIONS IN THE CIBOLA REGION.....................55

The Cibola Region: Boundaries and Chronology 56

The Physical Cibola Landscape 58

Population Aggregation and Settlement Nucleation A.D. 900-1400 62

Pueblo II: A.D. 900-1150 62

Pueblo III: A.D. 1150-1275 64

Pueblo IV: A.D. 1275-1400 68

Summary 72

Research Objectives and Organization of Research 73

4 ARCHAEOLOGICAL APPROACHES TO FOODWAYS 78

Archaeological Remains of Food 78

Plant Food Data 79

Cibola Plant Database 81

Maize Cob Row-Number 84

Animal Food Data 86

Faunal Indices 88

Archaeological Remains of Foodcrafts 90

Groundstone Data 90

CHAPTER Page

Material and Size 92

Metate Type and Form 93

Mano Use-Life 96

Number of Used Sides 97

Ceramic Vessel Data 100

Ware/Type and Vessel Portion 101

Vessel Form 101

Vessel Treatment and Heat Exposure 102

Vessel Curvature, Rim Diameter, and Rim Form 103

Archaeological Remains of Food Preparation and
Cooking Features 106

Thermal Features 106

Mealing Bins 109

Chapter Summary 109

5 CORN RAISING; CIBOLA FOOD PRODUCTION..................................112

Ethnographic and Archaeological Evidence for Food Production 113

Domesticated Plant and Animal Foods A.D. 900-1400 114

Varieties of Maize 115

Turkeys 119

Hunted and Gathered Foods 120

Encouraged and Gathered Plants 122

Agrestal Species and Cultivated “Weeds” 124

CHAPTER Page

Nuts and Berries 127

Yucca and Cacti 128

Summary 130

Aggregation, Nucleation, and the Scale of Food Production 131

Agricultural Intensification 132

Meat Production and Procurement 135

Chapter Summary 138

6 HOW THE ROOFS GROAN; CIBOLA FOOD STORAGE AND PREPARATION 141

Food Processing and Storage 142

Ethnographic Accounts of Food Processing and Storage at Zuni 143

Archaeological Evidence of Food Storage 145

Decorated Storage Jars 147

Summary 149

Food Preparation 150

Ethnographic Accounts of Food Preparation at Zuni 150

The Daily Grind: Mano and Metate Manufacture and Use 153

Material Choice and Tool Size 154

Metate Types 157

Trough Metate Forms 160

Mano Use-Life 162

CHAPTER Page

Summary 165

Mealing Bins and the Organization of Food Preparation 165

Grinding and Groaning: Why Make (more) Breadstuffs? 167

Chapter Summary 170

7 FOOD SINGS IN THE COOKING-POT; COOKING IN THE CIBOLA REGION 173

Cibola Cooking and Cuisine: Ethnographic and Archaeological Evidence 174

Cibola Kitchens and Cooking Features 176

Hearths and their Contents: Fuels and Ingredients 180

Roasting and Cooking Animal Foods 181

Toasting and Cooking Plant Foods 183

Tomatillo: Signature Flavors of the Central Zuni Area 186

Cooking Vessels and Cuisine: Vessel Treatment and Heat Exposure 188

Summary 190

Feeding a Crowd: Cooking and the Scale of Commensality 191

Corrugated Cooking Jars 194

Summary 197

Flatbread Cuisine in the Cibola Region 198

Chapter Summary 201

CHAPTER Page

8 A FEAST OF MEAT, A DAY OF SOCIABILITY; SERVING, CONSUMING, AND DISCARD 204

Ethnographic Accounts of Meals at Zuni 206

Daily Meals and Feasts A.D. 1150-1400 209

The Performance of Supra-Household Consumption A.D. 1150-1400 210

Serving and Consuming in the Cibola Region 214

Chapter Summary 222

9 CIBOLA BREADSTUFF 226

Cibola Foodways and Social Transformations 227

Foodways and Population Aggregation A.D. 1150-1275 228

Settlement Nucleation, Migration, and Foodways A.D. 1275-1400 233

Summary 237

Continuity and Change: The Practice and Performance of Cuisine 238

Continuity in Cuisine 239

Migration, Interaction, and the Practice of Cuisine 241

Innovations in Cuisine, Performance, and Identity 244

Summary 247

Commensal Scale and Economic Organization 249

Commensality, Specialization, and the Scale of Food Production 249

CHAPTER Page

Domestic and Political Economies: Cooperation and Autonomy 252

Summary 253

Conclusions 254

REFERENCES 257

APPENDIX

A ZUNI NAMES FOR PREHISPANIC PLANT AND ANIMAL FOODS 308

B CIBOLA PLANT DATA 311

C CIBOLA FAUNA DATA 315

D CIBOLA METATE AND MANO DATA 318

E CIBOLA CERAMIC VESSEL DATA 320

F CIBOLA THERMAL FEATURE DATA 322

G ETHNOGRAPHIC RECORDS OF PLANT INGREDIENTS AND PREPARATION AND COOKING TECHNIQUES AT ZUNI 324

LIST OF TABLES

Table Page

2.1. Major Themes and Select Scholarly References......................................16

3.1. Core Sites Included in Study..60

3.2. Aggregation and Social Transformations across Cibola Region 73

3.3. Organization of Research Objectives, Data, and Analyses 75

4.1. Cibola Plant Food Taxa A.D. 900-1400 83

4.2. Metate Type/Form Codes and Descriptions of Advantages and Disadvantages 95

4.3. Mano Codes and Descriptions of Extended versus Intensive Use Strategies 98

4.4. All Variables Measured on Ceramic Vessels 100

4.5. Thermal Feature Type Codes and Description (adapted from Peeples 2011, Table 7.2; Lowell 1999, Table 1) 108

5.1. Recorded Cibola Maize Landrace, Row Number, and Kernel Endosperm Characteristics A.D. 900-1400 (after Adams 1994, Table 16.1) 116

5.2. Archaeological Indicators of Turkey Husbandry in the Cibola Region..120

5.3. Cibola Animal Food Taxa A.D. 900-1400 121

5.4. Common Plant Food Taxa in the Cibola Region A.D. 900-1400 123

5.5. Taxonomic Identification and Ubiquity of Cibola Plant Foods (n=number of flotation samples) 134

6.1. Statistical Summary of Decorated Jar Volumes 148

Table Page

6.2. Select Ethnographic Estimates for Daily and Weekly Hours Spent Grinding 152

6.3. Zuni Names for Types of Maize Flour Processed into Differing Degrees of Fineness 152

6.4. Statistical Summary of Metate Widths and Mano Lengths 155

6.5. Cibola Metate Types A.D. 900-1400 159

6.6. Cibola Metate Types by Settlement Area and Period 160

6.7. Cibola Trough Metate Forms A.D. 1150-1400 161

6.8. Number of Used Sides and Wear Patterns on Cibola Manos 163

6.9. Statistical Summary Mano Lengths by Number of Used Sides and Wear Pattern 164

7.1. Extramural Thermal Features and Domestic Hearth Modifications 177

7.2. Evidence for Butchering and Burning of Turkeys and Artiodactyls 183

7.3. Plant Remains Recovered from Domestic Hearths A.D. 900-1400. Bold indicates plant food taxa commonly (>20% of sites) recovered across the Cibola Region (Chapter 5, Table 5.4) 185

7.4. Statistical Summary of Domestic Cibola Hearth Areas 192

7.5. Statistical Summary of Cooking Jar Volumes 194

7.6. Archaeological Evidence for *He-we* and *Piki* Stones 199

8.1. Ethnographic Examples of Daily and Special Commensal Meals at Zuni....................207

8.2. Statistical Summary of Ceramic Bowls by Site 215

Table | Page

9.1. Trajectories of Cuisine, Commensality, and Social Transformation across the Cibola Region 228

A.1. Scientific and Common English and Zuni Names for Plant and Animal Foods 309

B.1. Cibola Plant Database Sites and Analyzed Macrobotanical and Pollen Samples 312

B.2. Cibola Cob Row-Numbers 314

C.1. Table C.1. Cibola Site NISP and Artiodactyl, Turkey, and Lagomorph Indices 316

G.1. Ethnographic Records of Plant Ingredients, Preparation Steps, and Cooking Techniques at Zuni Pueblo 325

G.2. Ethnographic Records and Recipes of Maize Breadstuffs at Zuni Pueblo 327

LIST OF FIGURES

Figure Page

1.1. Map of the Greater Cibola Region in the U.S. Southwest (modified from Peeples et al. 2017, Fig. 22.1) 9

3.1. Map of the Cibola Region Showing Major Settlement Areas, Core Pueblo III (red) and Pueblo IV (blue) Period Sites, and Major Geographic Areas Referenced in this Study (modified from Peeples 2011, Fig. 3.2.) 57

4.1. Mano Wear Profiles (after Adams 2002:113, Fig. 5.12) 99

4.2. Comparison of Cibola Cooking Jar Orifice Diameters to Body Sherd Volume Measures of Reconstructable Jars (n=105) 104

5.1. Percentages of Maize Cob Row-Numbers A.D. 900-1400 117

5.2. Ubiquity of Maize across the Cibola Region A.D. 900-1400 132

5.3. Ubiquity Measures of Cultigens, Weedy Annuals, and Wild Economic Plants 133

5.4. Cibola Artiodactyl Index Values A.D. 900-1400 135

5.5. Cibola Turkey Index Values A.D. 900-1400 136

6.1. Kernel Density Estimates and Histograms of Cibola Decorated Jar Volumes (l)...149

6.2. Mano length (cm) by Settlement Area and Period (n=641) 156

6.3. Percentage of Cibola Metate Types A.D. 900-1400 158

6.4. Percentage of Manos by Number of Used Sides 163

6.5. Proportions of Metate Type and Maize Row-Number A.D. 900-1400 169

Figure Page

7.1. Tomatillo Fruit and Seeds (*Physalis* sp.) 187

7.2. Hearth Area (cm2) by Settlement Area and Period (n=202) 193

7.3. Kernel Density Estimates and Histograms of Cibola Cooking Jar Volumes (l) (n=3397) 195

7.4. Proportion of Large Cooking Jars between 30-50 Liters at All Sites 196

8.1. Ceramic Bowl Diameters (cm) by Ware and Period 217

8.2. White Mountain Red Ware and Zuni Glaze Ware Bowl Diameters (cm) by Type 218

8.3. Kernel Density Estimates and Histograms of St. Johns Polychrome (n=595) and Heshotauthla Polychrome Bowl (n=482) Rim Diameters (cm) at Regional, Sub-Regional, and Individual Settlement Scales 221

Chapter 1:

THE INFLUENCE OF OUR BREADSTUFF

"Does the reader then, realize with me, how far-reaching has been the influence of our breadstuff (Cushing 1920:250)?"

This study is concerned with the relationships between foodways and social change. In this dissertation I argue that periods of social transformation not only influence how people relate to and through food, but that foodways play an important role in processes of social transformation. Foodways, the ways we produce, prepare, and consume foods, are an important part of every human society and culture. Foodways have not only biological, but symbolic, social, and political significance. Ideas about food matter, as do the embodied techniques and technologies used to prepare and consume it. The meals we share and consume play a central role in building memories (e.g., Holtzman 2006; Sutton 2001) and negotiating social relationships (e.g., Appadurai 1981; Hastorf 2016), especially at larger social and political scales (e.g., Dietler and Hayden 2001a; Wiessner and Schiefenhövel 1996). Access, cultural values, and personal preferences for food directly influence diets and daily activities, what we consume, and with whom we consume it. Many layers of our social identities, including understandings of personhood, gender, and ethnicity are expressed and reinforced through our foodways (e.g., Counihan 1999; Twiss 2012). Both as symbols and events, foods and feasts become vehicles and rallying points for mobilizing coordinated and collective social and political action (e.g., Appadurai 1988; Dietler and Hayden 2001; Mintz and Du Bois 2002; Fan 2013; Wilk 2006). The fundamental importance of foodways to social, political, and economic aspects of life means that studies of past social transformations must consider social drivers of food change in the past and address how foodways factored into processes of social change.

The complex relationships between foodways and processes of social change can be considered with respect to two iconic Native (North) American "breadstuffs" that each emerged from periods of profound social transformation: the *piki* bread of the Hopi Tribe that can be traced back to the mid-13th century (Adams 1991; Dedecker 2005), and the frybreads or "Indian tacos" that were developed by tribes in the 19th century (Mihesuah 2016; Power and Power 1984). The social transformation associated with the innovation and adoption of *piki* bread involved rapid changes in demography and social organization as previously separate clans came rapidly together to form large communities in northeastern Arizona in the mid-13th century (Adams 1991, 2002; Bernardini 2005). In the case of frybread, its historical roots can be traced back to the devastating colonial processes of forced relocation, reservation formation, and the introduction of American government food commodities as traditional foodways were stripped away in the 19th century (Mihesuah 2016; Powers and Power 1984). Today, both *piki* bread in northeastern Arizona, and frybread across much of North America, are widely considered to be staples of traditional cuisine, benchmarks of culinary skill for women, and beloved symbols of shared social identities and histories. I briefly touch on the history and cultural significance of each bread below.

While consumed to a lesser extent at Hopi today, *piki* bread remains a highly valued food that is a staple of Hopi ceremonials and social events. Making *piki* bread requires both access to a specially prepared sandstone griddle and years of experience spent mastering how to prepare maize batter and then carefully apply and rapidly remove paper thin wafers of bread from a very hot griddle with ones' fingertips (Spencer and Sekaquaptewa 1995; Ritzenthaler 1966). *Piki* bread traditions can be traced back to the establishment of very large, dense towns in northeastern Arizona in the late 13th and early 14th centuries, a process associated with significant changes in sociopolitical organization, communal social identification, and religious practice (Adams 1991, 2002; Bernardini 2005). *Piki*-making rapidly became central to Hopi social and ritual life, and by the mid-14th increasingly formalized cooking features and specialized preparation equipment, including special incurved bowls, were produced (Adams 1991; Dedecker 2005). As *piki* breads became staples of Hopi cuisine, the work of producing very finely ground maize flour and preparing *piki* bread for ceremonials and other social events became key routine tasks for women, a change in daily food activities that had longstanding implications for the social roles, status, identities, and labor of Hopi women (e.g., Bartlett 1933; Mindeleff 1989; Ritzenthaler 1966). Today, being a skilled maker of *piki* remains a source of status, and pride for women, and *piki* breads are considered essential components of Hopi cuisine, ritual practice, and social identity (Flora et al. 2009; Spencer and Sekaquaptewa 1995).

The ascension of frybread to national recognition and symbolic importance is a relatively recent phenomenon. Frybread has featured prominently in media produced by and for Native audiences, such as the 1998 film *Smoke Signals* or the 2011 mockumentary *More than Frybread*. Frybreads served plain, or featuring a range of sweet and savory toppings, have become a ubiquitous element of events like pow wows, Indian markets, or other festivals celebrating and showcasing intertribal indigenous North American culture (Lewis 2018; Mihesuah 2016; Vantrease 2013). In 2005 frybread was declared the official bread of South Dakota[1], an annual National Indian Taco Championship[2] was established in Pawhuska, Oklahoma in 2003, and until recently[3] frybread making was a popular talent portion of Navajo beauty pageants. Frybread is even featured as a staple traditional food on menus at the Mitsitam Café[4] at the National Museum of the American Indian in Washington D.C. Thus, as a food of festivals, and also an emerging symbol of Native identity, resurgence, and resistance, frybread has come to be a food associated with the collective expression of Indigenous survival, pride, and identity across North America (Lewis 2018; Vantrease 2013). The growing social and symbolic value of frybread is controversial[5] however, given the bread's colonial history (Mihesuah 2016), and growing concerns over the over-consumption of fatty, calorie-rich foods like frybread for communities struggling with extremely high rates of obesity and diabetes (Lewis 2018; Smith and Wiedman 2001).

Together, *piki* and frybread offer insights into processes through which foodways factor into and are also transformed as part of processes of social transformation. First, both breads provide examples of the important role that foods play in the construction and expression of shared social identities and histories. Frybread provides a clear contemporary example of how foods can become important symbols of collective identities, even in cases where there are substantial underlying social and cultural distinctions and diverse historic relationships with that food. Second, the histories of both breads demonstrate how the special significance and value of these breads was closely

[1] https://statesymbolsusa.org/symbol-official-item/south-dakota/state-food-agriculture-symbol/fry-bread
[2] http://www.pawhuskachamber.com/event/national-indian-taco-championship/
[3] http://www.santafenewmexican.com/news/local_news/miss-navajo-nation-contest-is-parting-ways-with-fry-bread/article_4767ec3b-de33-530f-834f-d8f0f640afba.html
[4] https://americanindian.si.edu/visit/washington/mitsitam-cafe/
[5] http://www.nbcnews.com/id/9022063/ns/us_news-life/t/icon-or-hazard-great-debate-over-fry-bread/#.W8YVcWhKiUk

tied to their place in public rituals and large commensal events and, how considerable effort and social importance can become attached to producing and preparing foods for special meals. Finally, *piki* in particular highlights how changes in cuisine may have dramatic, long-lasting implications for the labor and lives of individuals tasked with preparing and providing food for daily meals and special commensal events.

Changes in cuisine, past and present, are often interpreted as signals of broader social and political transformations (e.g., Brumfiel 1991; Mintz 1985). In the case of frybread, these transformations include colonization, forced migrations, the loss of food sovereignty, and complex contemporary identity politics. In other circumstances, changes in cuisines are understood to indicate the differential adoption or emulation of new food tastes and in the social values, identities, and/or ideologies associated with producing and consuming these foods (e.g., Crown 2018; Joyce and Henderson 2007; Wilk 2006). The adoption and spread of *piki* bread and similar flatbread cuisines across the northern U.S. Southwest has often been interpreted in this light (Adams 1991). While changes in foodways are more often interpreted by as "evidence" for or reactions to social transformations, as opposed to playing an active role in processes of social change, histories of both *piki* and frybread demonstrate how both persistence and change in cuisine are very often at the center of social and political action and changes in both domestic and political economies. Thus, addressing the roles and relationships between food and processes of social change requires a multi-scalar temporal and spatial perspective that can situate changes in daily food activities and decisions into broader environmental, socioeconomic, and political genealogies or histories over time (e.g., Mintz 1985; Logan and Stahl 2017; Pauketat 2001; Wilk 2006).

Piki bread was not the only prehispanic maize flatbread tradition to emerge in U.S. Southwest. Both Eastern and Western Pueblos have a variety of similar traditional maize flatbreads, including the Tewa *mo-wa* and the Zuni *he-we,* that remain important parts of traditional cuisine and the celebration of ceremonial feast days today (Cushing 1920; Edaakie 1999; Robbins et al. 1916; Stevenson 1915; Swentzell and Perea 2016; Whiting 1940). Archaeological evidence indicates that by the early 14th century flatbread cuisines were adopted to at least some degree across the northern U.S. Southwest (Adams 1991; Snow 1990), suggesting that this widespread change in cuisine was linked in important ways to transregional processes of social transformation involving rapid population aggregation, migration, settlement nucleation, and changes in social identification, interaction, and religious practice (Adams 1991; Adams and Duff 2004a; Mills et al. 2013; Peeples 2018). This study examines the interrelationships between social transformations and foodways in the Cibola region of east-central Arizona and west-central Mexico (Fig. 1.1) in the 13th and 14th centuries. As with the example of *piki* presented above, this study investigates the adoption of maize flatbread cuisines in the Cibola region and considers how this and other changes in cuisine and commensality were at the center of broader transformations in sociopolitical and economic life of rapidly aggregating communities in the early 14th century.

The Case Study

Foodways in societies at every social scale are closely linked and connected in complex ways to processes of social change. In this dissertation, I address relationships between foodways and well-documented processes of social transformation across the Cibola region in the Pueblo III (A.D. 1150-1275) to Pueblo IV periods (A.D. 1275-1400)

(Fig 1.1). What I argue in this dissertation is that food provides an important window into periods of social transformation and further that changes in foodways were an essential part of these transformations. I demonstrate this by drawing on a wide range of archaeological materials and ethnographic research to document how increases in the scales of food production and the complexity of cuisine over much of the Cibola region were largely driven by processes of social and political reorganization. I argue that acts of provisioning and sharing food at communal commensal events were an essential part of the social work of integrating and maintaining large, dense communities in periods of rapid population aggregation and settlement growth in the Cibola region in the 13th and 14th centuries. I suggest that studies of foodways, and specifically the social dimensions of food, offer a promising and often underutilized source of information about past processes of population aggregation, social integration, and transformations in the political economies of small-scale societies the past.

The Cibola region provides an ideal context to examine and compare relationships between foodways and processes of rapid social change. For over a century the Cibola region and modern Zuni Reservation have been the focus of ethnographic, historical, and archaeological research concerning matters of subsistence, social interaction and identification, sociopolitical organization, and processes of population aggregation, migration, and settlement growth and nucleation (e.g., Cushing 1920; Duff 2002; Gregory and Wilcox 2007; Huntley 2004; Kintigh 1985; Kintigh et al. 2004; Martin et al. 1962; Peeples 2018; Peeples et al. 2017; Schachner 2012; Spier 1917; Watson et al. 1980). Processes of settlement reorganization and social transformation broadly characteristic of the Pueblo IV period occurred quite early in the Cibola region relative other portions of the northern U.S. Southwest (Kintigh 2007; Schachner 2012; Peeples 2018). Further, in many portions of the Cibola region population aggregation and settlement reorganization involved relatively little change in overall population levels (Kintigh et al. 2004). As such, the Cibola case allows for a unique comparative examination foodways at multiple social and spatial scales through time.

In this study of foodways, my research questions center on issues surrounding the social drivers and implications of food change. Specifically, I ask how the management and organization of food production and consumption activities shifted and were shaped through processes of rapid population aggregation, migration, and the establishment of large towns and social communities, all of which are archaeologically well-documented across the Cibola region in the late 13th century. To do this I employ two complementary lenses: (1) *cuisine*, the cultural logics and embodied traditions of food practices; and (2) *commensality,* or the socioeconomic and political dynamics of shared meals. I view cuisine and commensality each as acting or existing as a part of a larger social and cultural domain of daily food activities. Cuisine, our food culture, encompasses the field of shared techniques, categorizations, symbols, and rules of conduct guiding food behaviors. Commensality, the social dynamics and interactions that surround food, directs attention to the event, performance, power, and cost of the consumed meal.

To address changes in cuisine and commensality at multiple spatial and temporal scales in the past, this study incorporates a mixture of ethnographic and ethnoarchaeological research, an extensive body of archaeological legacy data, and analyses of a range of archaeological collections including: (1) plant and animal food remains; (2) food-related material culture including ceramic containers and sets of manos and metates; and, (3) the features and spaces where various food storage, preparation, and consumption activities occurred. Together, these data allow me to compare trajectories of cuisine and commensality both temporally and spatially across three Cibola settlement areas: Central Zuni, the El Morro Valley, and the Upper Little Colorado regions. While populations aggregated in each area, the process differed in each with respect to the extent of population growth, the pace of social change, and the degree to which it involved the incorporation of local populations versus distant migrant groups (Chapter 3).

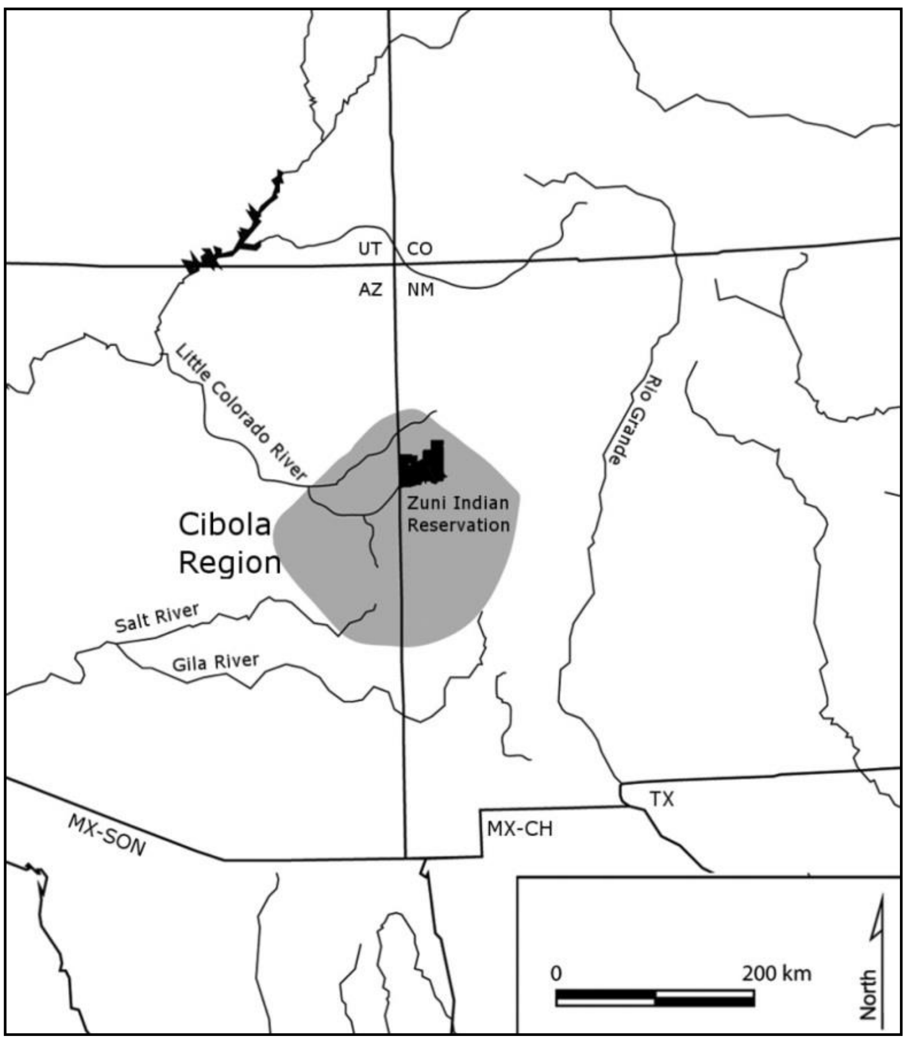

Figure 1.1. Map of the Greater Cibola Region in the U.S. Southwest (modified from Peeples et al. 2017, Fig. 22.1).

By examining how different foods, technologies, and culinary techniques became incorporated into daily life through time across the Cibola region, this study provides a unique perspective into the ways individuals and households were able (or unable) to connect to and participate in social and political life at multiple scales through their food practices. At the same time, the synthetic analysis of foodways also allows me to address and compare how daily food production and consumption practices were shaped by changes in cuisine and commensality that occurred at local, regional, or transregional scales. While settlement patterns and other more obvious manifestations of aggregation have been studied frequently, this examination of foodways during periods of aggregation and social reorganization provides new insights into the micro-scalar processes of social transformation, cuisine change, and economic intensification associated with increases in settlement size, density, and social diversity. Beyond the Cibola case, the comparative, multi-scalar approach taken in this study provides a useful framework for other studies considering the interplay between daily food practices and processes of social transformations in small-scale societies.

Organization of Dissertation

Chapter 2 provides the theoretical underpinnings of this research. In Chapter 2, I outline the two conceptual lenses employed in this study, cuisine and commensality, and develop expectations concerning the interplay between broader social transformations involving population aggregation and foodways. Chapter 3 presents the details of the Cibola case study, providing a historic overview of the social transformations that have been well-documented across of Cibola region A.D. 900-1400. This chapter sets up the comparative analyses of cuisine and commensality addressed in the remainder of the dissertation. Chapter 4 provides a detailed overview concerning the various types of archaeological data, sampling, and analytical methods that provide the foundation for understanding how foodways changed across the Cibola landscape.

The following series of analytical chapters (5-8) weave together a range of stone, bone, plant, and ceramic vessel data to address histories of Cibola foodways and their social dynamics in the 13th and 14th centuries. These chapters follow the social life of food at multiple spatial and temporal scales. That is, these chapters follow the activities and remains of foods and food technologies from seed to storage jar to cooking pot and finally into the archaeological record. Chapter 5 focuses on food production. Here I evaluate histories of staple grown and gathered plant and animal food production, and compare different uses of local signature foods and flavoring agents across the Cibola region. I also draw on extensive databases of plant and animal remains to address the interplay between population aggregation and changes the nature and scale of food production and consumption over time. Chapter 6 focuses on the work within (or on top) of homes, where I examine changes in the intensity and organization of food storage, processing, and preparation activities. In this chapter I address how changes in cuisine and commensality intersected with domestic economies and the work of women preparing maize flours. Things heat up in Chapter 7, where I examine evidence for cooking and address how the cooking techniques and the social scale of cooking activities varied across the Cibola region through time. This is the chapter where I address direct evidence for the adoption of maize flatbread cuisine across the Cibola region. In Chapter 8, I shift from considering the work of making meals to examining food as it is served and consumed. Here I focus on changes for the social scale and performance of daily and supra-household commensal events.

Finally, Chapter 9 reviews how different trajectories in cuisine and commensal practice played out against broader regional and more local processes of settlement aggregation and social transformation across the Cibola region. Trajectories in cuisine observed across the Cibola region offer unique insights into processes of change in interaction and exchange within and between settlements, including how shifts in population circulation and the incorporation of distant migrants into settlements created social arenas that allowed for mixing and innovation in cuisine. Changes in public architecture, communal ideologies and identities, and likely religious practices were intertwined with the adoption of novel flatbread cuisines and important shifts in the nature and scale of supra-household commensal events. These changes in commensality, and in the labor of the men and especially the women producing, preparing, cooking, and serving food for them were central to the work of constructing and maintaining broader social communities in aggregated villages and large plaza-oriented towns. Overall, this chapter provides a synthesized discussion the of the contributions from this study, both in terms of understanding the role of food in the social transformations that reshaped the social landscape of the Cibola and northern U.S. Southwest in the late 13th and 14th centuries, and broadly for understanding how people relate to and through food in periods of social change.

Chapter 2:

FOOD AND SOCIAL CHANGE

"Food – it is indeed the definitive anthropological topic reflecting our fundamental natures, those of sociality, transformation, and sharing (Hastorf 2016:1)."

While food practices are shaped by a complex range of influences, including broad biological and environmental constraints, this research focuses on several social dimensions of food in relation to processes of social change. Anthropologists and scholars working in related fields have long emphasized the centrality of food to human societies (see Counihan and Van Esterik 2013; Mintz and Du Bois 2002). Food is a cultural construct; diets are shaped by cultural conceptions of food and understandings about the appropriate ways to produce and consume it. The production, distribution, and sharing of food at meals is foundational to economies and central to politics at every societal scale. Foodways play a central role in socialization, the construction of social identities, and in the making and maintenance of social relationships. As such, we might generally expect there to be important relationships between foodways and processes of social change. However, the interplay between food practices and broader process of population aggregation and social coalescence have received relatively little attention. Examining such relationships in the past often relies upon the materiality of foods and food activities: the archaeological remnants of produced and gathered ingredients, the vast array of tools and embodied techniques used to prepare and consume meals, and ultimately the physical signatures associated with producing and incorporating food into our bodies.

While much archaeological work on food consumption in recent decades has focused on feasts, the social meanings and political weight of such meals are rooted in shared understandings and valuations of the foods being produced, served, and consumed by participants in daily meals. Thus, to address the roles and relationships between food and social transformations requires a multi-scalar temporal and spatial perspective that can situate daily food activities and decisions into broader socioeconomic, political, and environmental contexts over time (e.g., Gifford-Gonzales 2007; Hastorf 2016; Logan and Stahl 2017; Pollock, 2012; Mills 2016; Mintz 1985; Stahl 2002; Wilk 2006). Studying daily food practices provides an important window into networks of food production and consumption decisions that can be scaled from households, to communities, and even to broader regional or global perspectives. By understanding how different foods, technologies, and culinary techniques became incorporated into or excluded from daily life through time, studies of past foodways shed light on the ways individuals and households were able (or unable) to connect to and participate in social and political life at multiple scales through their food practices (e.g., Bardolph 2014; Bruno 2014; Hastorf 2016; Logan 2012; Mills 2008, 2016).

Investigating the socioeconomic and political importance of daily food practices in the past leads me to draw upon a relatively wide range of concepts and literatures that touch upon food. In this chapter I present my theoretical framework in three sections. First, I provide a brief overview concerning the fundamental biological and social importance of food. Next, I define and outline my use of cuisine and commensality. Finally, I discuss several theories concerning population aggregation, coalescence, and the political and economic outcomes associated with increases in population density and social diversity. Altogether, these sections provide a series of ideas and expectations for foodways in periods of population aggregation and social transformation that are further operationalized and addressed as specific research questions for the Cibola case study in Chapter 3.

Foodways in Mind, Body, and Society

Foodways have not only biological, but symbolic, socioeconomic, and political significance. By producing and consuming food, individuals participate in the creation, expression, and negotiation of power, status, identity, memory, competition, and solidarity. As this dissertation is a study of foodways, as opposed to more narrow analyses of strictly diet or subsistence, this and the following chapters take a holistic and multi-scalar perspective on the importance of daily food practices in the past. Focusing on the roles and relationships between food and processes of social change I ask, drawing on multiple lines of archaeological, ethnographic, and ethnoarchaeological data, how individuals and households participated in and experienced the transformations of socioeconomic and political life in the Cibola region in the late 13^{th} century. At the same time, I also examine how daily food production and consumption practices were shaped by these events at different social and spatial scales.

For over a century, a vast amount of scholarship in anthropology and related fields has engaged with the social, economic, and political importance of food in human societies (Table 2.1). Some of the basic tenets concerning the fundamental biological and social importance of food include: (1) food is central to human social reproduction, socialization, and interaction; (2) the categorizations and the symbolic values of foodstuffs are culturally shared and influence food behaviors; (3) the daily repetitive acts and sensual qualities of foods participate in the production of human bodies as well as the social construction and communication of identities, memory, and place; (4) food choice, preference, and taste are grounded consciously and unconsciously in a complex milieu of *habitus,* personal experience, physiological, psychological, and broader economic, environmental, and political circumstances; and finally, (5) food produced, stored, and consumed as “gift,” commodity, or surplus plays a central role in the political economy.

Table 2.1. Major Themes and Select Scholarly Food References

Major Themes	References
Food is central to human social reproduction, socialization, and interaction	Appadurai 1981; Counihan 1999; Douglas 1966; Farb and Armelagos 1980; Hastorf 2016; Lévi-Strauss 1969; Mauss 1980; Richards 1939; Wiessner and Schiefenhövel 1996
Categorizations and the symbolic values of foodstuffs are culturally shared and influence food behaviors	Adapon 2008; Bourdieu 1984; Douglass 1966, 1972, 1984; Counihan 1997; Fischler 1988; Haaland 2007; Lévi-Strauss 1966; Miegs 1988; Rozin 1984; Salaman and Burton 1985
Daily acts and the sensual qualities of foods participate in the production of human bodies and the social construction and communication of identities, memory, and place	Adapon 2008; Counihan 1999; Fischler 1988; Hastorf 2016; Holtzman 2006; Hamilakis 1999; Douglas 1984; Miegs 1988; Ohnuki-Tierney 1993; Proust 1934; Sutton 2001, 2010
Food choice, preference, and taste are grounded in a complex milieu of personal and broader economic, environmental, and political circumstances	Bourdieu 1977, 1984; Fischler 1988; Goody 1982; Hastorf 2016; Lalonde 1992; Macbeth 1997; Mintz 1985, 1996; Miracle and Milner 2002; Rozin 1984; Smith 2006; Stahl 2002; Sutton 2001, 2010; Wilk 2006; Weismantel 1988
Food plays a central role in the political economy	Appadurai 1981, 1988; Bray 2003a; Brumfiel 1991; Dietler and Hayden 2001a; Hastorf and Foxhall 2017; Hayden and Villeneuve 2011; Mauss 1980; Mintz 1985; Morehart and DeLucia 2015; Pollock 2012; Sahlins 1972; Saitta and Keene 1990; Smith 2015; Spielman 2002; Warde 1997; Wilk 2006

In addressing relationships between food and social change, there is a need for studies that examine the mechanisms through which societies relate to and through food, both in daily meals and special consumption events (e.g., Curtin 1992; Gosden 1999; Hastorf 2016; Klarich 2010; Pollock 2012; VanDerwarker et al. 2007). In the following sections I discuss the two interrelated concepts, cuisine and commensality, that I employ to do this in the following study of Cibola foodways. Together, these concepts allow me to address: (1) the dynamic relationships between food and social change; (2) the tensions between continuity and change in cuisine; and (3) the linkages between the nature and scale of daily food activities and the broader economic and political power of food as it is exchanged, performed, and consumed.

Cuisine

Cuisine is one of the two complementary conceptual lenses I employ in this dissertation to address relationships between food and social changes in the prehispanic Cibola world. Studies of cuisine direct attention to daily food decisions, bodily practices, and uses of various food production and consumption technologies that can be examined to understand changes in food behaviors, values, and preferences relative to broader sociopolitical processes in the past. Addressing changes in cuisine involves asking questions about the various factors that influence access to food resources and knowledge, the mechanisms through which food tastes and preference develop, and the daily roles played by food in reinforcing or challenging social identities and relationships at every social scale.

In this study I examine trajectories in cuisine across the Cibola region, drawing on a sequence of archaeologically well-documented social transformations in the 13^{th} and 14^{th} centuries that involved to varying degrees episodes of rapid population aggregation, settlement nucleation, and social reorganization (Chapter 3). This comparative examination of cuisine across Cibola region allows for an assessment of the mechanisms and particular social arenas in which cuisines persisted or changed. At the same time, it also enables asking what such changes implied for the lives, labor, and the social identities of those involved in producing, preparing, and consuming food. This last part explicitly entails considering relationships between foodways, gender, and social change.

Women cross-culturally take on the majority of food preparation and cooking tasks, meaning that changes in cuisine may particularly affect the labor of women. Women also play a crucial and often highly valued role as experts, innovators, and teachers of culinary techniques (e.g., Adapon 2008; Crown 2000a, 2000c; Counihan 1999; Gero and Conkey 1991; Hastorf 1991, 2016; Lowell 1991; Spielmann 1995). As food preparation and cooking tasks are closely linked to food production activities, this also means that changes in cuisine often involve some degree of adjustment in the nature (i.e., what is produced) or scale (i.e., how much is produced) of agricultural production and hunting activities. In the prehispanic Cibola region farming and hunting were likely predominately male activities (Crown 2000a; Cushing 1920; Murdock and Provost 1973; Potter 2004). In the following sub-sections, I briefly outline how I define cuisine for this study, discuss the conservative versus fluid nature of cuisine, and map out some ways in which cuisine and periods of social reorganization and transformation might be expected to interact.

Essential Ingredients

While "cuisine" is derived from the Latin words for kitchen (*culina*) and cooking (*coquina*), today cuisine is typically used to reference particular regional or ethnic cooking techniques and flavors (e.g., Rozin 1978; Rozin 1992). Alternatively, differentiated or "haute" cuisines have traditionally been associated with the cooking methods and tastes of different social classes or elite culinary specialists (e.g., Bourdieu

1984; Goody 1982). As Zilkia Janer (2007) has noted, the common, colloquial association between "cuisine" and high social status can be linked to the privileged position given to Eurocentric, specifically French, culinary traditions as the accepted global standards of culinary teaching and excellence. Academically, characterizations and interpretations of cuisine, much like concepts of "identity", often in practice remain nebulous and fuzzy (Mintz 1996:92-105).

In defining cuisine here then, the first step is perhaps to distinguish between diet and cuisine. Diet refers to the consumption of specific types of food, the amounts consumed, the timing and typical frequency of ingestion, and the nutritional values of those foods (i.e., calories, fats, protein, etc.). In contrast, and as used in this study, cuisine can be thought of as a culturally shared style and understanding of food practices involving signature ingredients, distinctive flavors, and the use of habitual bodily techniques and technologies to produce and consume foods in a particular place at a particular time. While diets might be expected to vary between individuals and households depending on gender, age, class, and the economic or seasonal availability of resources, cuisines are broadly speaking expected to be shared communally or culturally, to change slowly, and to vary regionally (Bourdieu 1984; Goody 1982; Mintz 1996; Weismantel 1988).

Cuisine encompasses a sense of shared symbolic understandings of foodstuffs, technologies, and the cultural logics or rules guiding food preparation, serving, and consumption or avoidance behaviors (e.g., Appadurai 1981; Bourdieu 1984; Counihan 1999; Douglas 1966, 1972; Farb and Armelagos 1980; Haaland 2007; Lévi-Strauss 1966; Meigs 1988; Rozin 1984; Weismantel 1988). In other words, cuisine involves shared categorizations or taxonomies of consumable ingredients and habitual food practices. Everyone categorizes the various plants, animals, minerals, fungi etc., that they consume in terms of what is edible, the states, seasons, or times when they are consumable, and who can appropriately prepare, serve, and ingest them (i.e., in relation to status, gender, age, etc.). These aspects of cuisine directly impact food behaviors, including decisions about how and how much various plants and animals should be raised, gathered, and grown. They also influence decisions concerning how and who should prepare, serve, and consume them. Together, the social values and quotidian nature of food practices lend symbolic, social, and political power cuisine, and give food a central role in the construction and expression of social identities, especially in the context of meals (e.g., Adapon 2008; Appadurai 1981; Douglas 1972; Haaland 2007; Hastorf 2016; Dietler 2001; Joyce and Henderson 2007; Ohnuki-Tierney 1993; Potter and Ortman 2004; Smith 2006; Twiss 2007, 2012; VanDerwarker et al. 2007; Weismantel 1988; Wilk 2006). I further expand on these concepts and the important overlaps between food's cultural and social importance in the section on commensality.

Cuisines are not only "good to think" but also involve a wealth of bodily knowledge and practice or "techniques of the body" (*sensu* Mauss 1973; see also Adapon 2008; Curtin 1992; Hamilakis 1999; Logan and Cruz 2014). Culinary skills and techniques are practiced and socially transmitted as part of learning networks (Schiffer and Skibo 1987) or "communities of practice" (c.f., Lave and Wenger 1991). The skills associated with preparing, cooking, serving, and consuming foods are often acquired at a young age and mastered over a lifetime through daily repeated practice (Adapon 2008; Counihan 1999; Farb and Armelagos 1980; Goody 1982). Thus, the embodiment of cuisine involves not only the physical incorporation of foods and extensive interactions with ingredients and teachers, but also the daily use and maintenance of tools, features, and the spaces used to prepare, cook, serve, and consume foodstuffs. These material attributes of cuisine make it a frequent subject of archaeological analysis, particularly in studies seeking to understand how cultural forms and different kinds of social identities (e.g., ethnicity, gender, age, socioeconomic status, religion) were created, negotiated, and experienced in the past through food practices (e.g., Bray 2003b; Crown 2000a, 2000c; Gero 1992; Graff and Rodriguez-Elia 2012; Gumerman 1997; Haaland 2007; Hastorf 2012, 2016; Joyce and Henderson 2007; Lightfoot et al. 1998; Logan and Cruz 2014; Spielmann et al. 2009; Turkon 2007; Twiss 2007, 2012).

Cuisines are often associated with specific core or signature ingredients and distinctive flavor combinations or "flavor principles" (Rozin 1973; Rozin 1978). These sensory aspects of food are tightly tied to culturally shared notions of taste, and to the social construction of identity, memory, place, and history (e.g., Adapon 2008; Bourdieu 1984; Frank 2011; Hastorf 2016; Holtzman 2006; Mintz 1996; Smith 2015; Sutton 2001, 2010; Wilk 2006). Flavors are typically the most memorable and socially significant aspects of meals for consumers (Adapon 2008; Sutton 2001, 2010). Preferences and desires to reproduce, or in some cases mimic or substitute, particular flavors and textures, guide the frequent use of specific culinary techniques and recipes, building on and reinforcing memories of past meals (Counihan 1999; Goody 1982; Smith 2006; Wilk 2006). As such, studies of cuisine, past and present, should pay special attention to how flavoring agents and various food preparation, cooking, and serving techniques are used to shape and communicate the sensual experience of food consumption, particularly in more public arenas.

In small-scale agricultural societies, signature ingredients and flavors generally can be assumed to consist of largely locally available ingredients, meaning that, "cuisines can ultimately be considered, the foods of a *place* (Mintz 1996: 96, emphasis in the original)." Lois Ellen Frank (2011) makes compelling arguments that place and local ingredients should be considered one of the most central, enduring, and socially valued components of Native American cuisines (see also Swentzell and Perea 2016). Thus, studies of cuisine, past and present, need to engage deeply with issues of landscape, place, mobility, and the nature of local economies. While global food networks today may allow for individuals to move great distances and still access many of the specific ingredients needed to reproduce certain cuisines (e.g., Harbottle 1997), instances of social transformation involving migration, especially in the past, raise questions about how different aspects cuisines might be impacted by long-distance population movement. At smaller spatial scales, changes in population circulation and landscape access following population aggregation, especially as a response to conflict, warfare, and violence (e.g., Fish 2000:187-188; VanDerwarker and Wilson 2017), are also factors that might be expecting to have lasting impacts on cuisine. Such questions concerning cuisine, mobility, and migration are further explored in Chapter 3.

The Conservative Nature of Cuisine

As this study is interested in foods as part of processes of social change, one area to address is the degree to which or ways in which cuisines are (or are often thought to be) conservative or unreflexive practices and markers of social identity (e.g., Bourdieu

1984; Farb and Armelagos 1980; Goody 1982; Rozin 1973, 1984). When articulated, explanations for the conservative nature of cuisine usually boil down to a mixture of factors including: (1) the routinization and habitual nature of daily food activities; (2) the importance of food in socialization and socializing; (3) taste, food preference, and the links between food, memory, and identity; (4) digestive concerns; and, (5) the expense or difficulty of acquiring new culinary techniques and technologies. I touch briefly on each of these below.

The conservative nature of cuisine is often linked to the influence of learning networks, or the communities of practice that inform the transmission and habitual or routinized uses of different ingredients, techniques and technologies to produce, prepare, and cook foods (Crown 2000c; Farb and Armelagos 1980; Goody 1982:150-153). The culinary practices of one's cuisine, like other kinds of technological style or craftsmanship involve shared knowledge systems and specific bodily practices that are transmitted from generation to generation through teaching frameworks (Adapon 2008; Goody 1982: 151; Schiffer and Skibo 1987). In small-scale farming societies most of these activities would be learned through observation and direct instruction from peers and adult family members. The different motions, motor skills, and "recipes" needed to plant a field, hunt game, grind flour, leaven dough, and bake bread would be learned at a young age, practiced, and refined throughout a lifetime of daily and seasonally repeated activities.

The centrality of food to social life and society is also thought to make cuisines conservative. Food plays a key role food in socialization and foodstuffs are a central feature of both the major and the more minor social events that we participate in over our lifetimes (e.g., happy hours, holidays, birthdays, weddings, etc.). How one categorizes and values foods, as well as the rules guiding the serving and consumption of meals are internalized early in life and are continuously reinforced throughout a lifetime of repeated food activities and events (e.g., Adapon 2008; Appadurai 1981; Bourdieu 1984; Douglas 1972; Farb and Armelagos 1980; Goody 1982; Sutton 2001). These early life experiences surrounding food inform the development of food tastes and preferences and become central to understandings of personhood, gender, and other social roles and identities. Food then not only builds individuals physically but also participates in constructing "imagined" communities and larger society (Adapon 2008; Appadurai 1988; Hastorf 2016; Holtzman 2006; Isbell 2000; Potter and Ortman 2004; Weismantel 1988; Wilk 2006).

Social relationships, shared histories, and identities are continually created and reinforced through the important ties between foods and memory (e.g., Holtzman 2006; Sutton 2001, 2010). Recipes and cooking techniques are passed down through multiple generations, inspiring and maintaining memories of family, community, and place (e.g., Adapon 2008; Edaakie 1999; Frank 2011; Siskind 1992; Sutton 2001; Swentzell and Perea 2016). Thus, in some instances or social contexts, the desire to connect to and reinforce memories of past meals may discourage innovation or experimentation in culinary practices (Douglas 1972; Goody 1982:153). The ties between food and memory lie not only in the frequent, often subconscious, repetition of food activities but also in the rich sensory aspects of food (i.e., flavors, textures, odors, visual presentation, etc.) that play an important role in marking foods as edible, familiar, and desirable (Adapon 2008; Hamilakis 1999; Rozin 1984; Sutton 2010). In addition, specific core or signature ingredients and distinctive flavor combinations can communicate a wealth of social information about shared or differentiated social identities, histories, and beliefs (Farb and Armelagos 1980: 190; Hastorf 2016: 40; Macbeth 1997; Ohnuki-Tierney 1993; Smith 2006; Rozin 1973; Wilk 2006). As cuisines act as such important markers of social identity, experimentation, blending, and the display of certain food practices might be variously encouraged or discouraged, particularly in public settings, depending on the broader social and political context.

Biological considerations may also play a part in the maintenance of culinary traditions. As omnivores, humans experience simultaneous conflicting desires to consume familiar foods and to experiment with new tastes and flavors, hence the "Omnivores Paradox" (Fischler 1988; Rozin 1977). Age may also be a factor, as children are more neophobic than adults to new foods, flavors, and textures (e.g., McFarlane and Pliner 1997; Pliner and Stahlberg-White 2000), and as our sensitivity to taste may also decreases as we age (Farb and Armelagos 1980). New foods or styles of food preparation, even when executed correctly, can also be difficult to digest (Wing and Brown 1979). Devon Mihesuah (2016) provides a detailed history of the digestive distress and longstanding health problems experienced by many Native American peoples following the introduction of flour, lard, dairy, coffee, and other rations distributed as U.S. government food commodities on reservations and at Indian boarding schools (see also Lewis 2018). Finally, it may be expensive, time-consuming, or even socially inappropriate to gain access to teachers, techniques, or the technologies necessary to produce and prepare certain foods (Adapon 2008; Crown 2000c; Frank 2011; Mills 2008; Schiffer and Skibo 1987).

Continuity and Change in Cuisine

When we document changes in cuisine archaeologically, what do such changes signify given the above discussion concerning the generally conservative nature of cuisine? A review of the literature suggests that changes in cuisine are usually interpreted as signaling significant transformations of some kind, whether socioeconomic, political, and/or environmental in nature (e.g. Badenhorst and Driver 2009; Bardolph 2014; Bray 2003a; Brumfiel 1987, 1991; Crown 2000a; deFrance 1996; Hastorf 2012, 2016; Joyce and Henderson 2007; Logan 2012; Mills 1999, 2008; Spielman et al. 2009; Twiss 2007, 2008). Studies of foodways in colonial contexts provide a particularly rich source of understanding concerning the myriad of ways in which profound social, economic, ecological, and political disruptions or "entanglements" shape cuisine (e.g., Brumfiel 1987, 1991; deFrance 1996; Hastorf 2016:71-72; Holtzman 2009; Janner 2007; Logan 2012; Macbeth and Lawry 1997; Mihesuah 2016; Mills 2008; Mintz 1985; Oas 2017; Powers and Powers 1984; Spielmann et al. 2009; Stahl 2002; Wilk 2006).

Much work, however, remains for understanding the different mechanisms, contexts, temporal rates, and aspects or material correlates of cuisine which might be expected to change or persist through time (Douglas and Nicod 1974; Mills 2008; Wilks 2006). Macbeth and Lawry (1997:4) have proposed that changes in cuisine in many contexts are often a matter of *necessity* relating to broader environmental, economic, or political pressures (e.g., Badenhorst and Driver 2009; Brumfiel 1987; Crown 2000c; Spielmann et al. 2009). In other cases, changes in cuisine can be seen as more endogenous social processes involving emulation, differentiation, habituation, promotion, adoption, and/or the rejection of particular tastes and food preferences (e.g., Fuller 2005;

Hastorf 2016:41; Logan 2012:5-12, 323; Joyce and Henderson 2007; Macbeth and Lawry 1997; Sutton 2001; VanDerwarker et al. 2007; Wilk 2006). This general model of food practice and change can be seen as similar to but somewhat distinct from Bourdieu's (1984) concept of taste. While Bourdieu differentiates between the tastes of "necessity" and those of "liberty" or "freedom" (1984:6) both Bourdieu, and also Goody (1982), use this distinction to focus solely on differences in social class as opposed to other forms of social identification and distinction (see Mintz 1996). Overall, given the complex range of factors that simultaneously shape food practices, we might well expect a range of variability in the rate or degree to which cuisines persist through time and in the unreflexive or conscious nature of this process.

As I discuss in the final section of this chapter, periods of social transformation, particularly those involving population aggregation and community formation, often involve the development of new social institutions and changes in the organization of the political economy. As such, we might also expect there to often be some changes in the size, performance, and financing of supra-household commensal events. In comparing public ceremonial meals and daily household meals we might expect some differences in the degree of culinary freedom expressed by cooks. Daily household meals might allow for more creativity and experimentation in cuisine, or perhaps even the private cooking and maintenance of traditional cuisines by migrant households and relative social outsiders in aggregated settlements (Adapon 2008; Mintz 1996). As such, thorough comparisons of both household and supra-household meals are necessary to examine processes of change or experimentation in cuisine and the promotion (or rejection) of new foodstuffs. Where migration and population mixing occur, we might expect there to be communal shifts in culinary teaching frameworks if populations integrated over time, a process that might occur more rapidly in contexts where processes of population mixing were accompanied by simultaneous increases in the social scale and organization of food production, preparation, and cooking activities.

Ultimately whether investigating daily food practices over the *longue durée* or in particular episodes of dramatic social transformation, documenting *continuity* in culinary practices likely requires just as much explanation as documenting change. Caribbean cuisines, that developed out of a long history of colonization, social rupture, mixing, and globalization are characterized by and provide a view into contexts that celebrate the continued dynamic and flexible blending or “creolization” of ingredients, flavors, and cooking techniques derived from multiple continents (Carney 2016; Janner 2007; Wilk 2006). Experimentations in cuisine have also often been encouraged in the case of developing distinctive national cuisines (e.g., Appadurai 1988; Fan 2013; DeSoucy 2010; Wilks 2006). Altogether such studies suggest that relationships between the construction and expression of certain types of social identities (e.g., national, ethnic, religious) and the development or promotion of certain cuisines may be a particularly rich area of study in the past. While not dealing with the complexity of Spanish colonial entanglements, the 13th-14th century Cibola region provides an excellent case for addressing relationships between cuisine and social changes involving migration, population mixing, and collective social identity construction (Chapter 3).

The Social Value of Foods

In this final section on cuisine, I consider one important point of overlap between cuisine and commensality; the processes or mechanisms by which certain foods become socially valued. Changes in cuisine are often interpreted to indicate the differential adoption, emulation, or rejection of new food tastes and/or changes in the social values placed upon producing and consuming certain foods (e.g. Bray 2003a; Crown 2018; Fuller 2005; Gumerman 1997; Joyce and Henderson 2007; Mills 2008; Smith 2006; Turkon 2007; Weismantel 1988; Wilk 2006). This is how the development of differentiated or specialized “haute cuisine” is often presented in relation to the emergence of social complexity, stratification, and inequality (Appadurai 1981; Bray 2003b; Bourdieu 1984; Hastorf 2016:40-41; Goody 1982; Mintz 1996). While the adoption of new social values or ideologies may not always directly correlate with changes in cuisine, there are substantial reasons to think that culinary practices are a promising place to look for such developments.

Moreover, the values we place upon certain foods can be understood to be highly political and linked in significant ways to economic organization and scales at which foods are produced, exchanged, and consumed. Today, increasing global affluence and demands for meat consumption present serious challenges for agricultural sustainability, food security, and health (Meyers and Kent 2003). As increasing amounts of crops and agricultural lands are devoted to livestock production this decreases potential global food supplies, diminishes local food security, and is environmentally unsustainable (Foley et al. 2011; Horlings and Marsden 2011; Tilman and Clark 2014). Ultimately, whether precipitated by seemingly external or internal factors, changes in cuisine and how foods are valued and consumed often have significant environmental impacts and repercussions for the daily lives, labor, and status of individuals who typically produce, prepare, cook, and serve food.

Given the power of cultural food values, what mechanisms explain how value is attached to particular foods, and how do shifts in food values influence production and consumption behaviors? Foods become valued through various means, including not only the politics of exchange and social contexts of the reciprocal giving or receiving gifts of food, but also the symbolic associations linking foods with particular places, histories, ideologies (i.e., religious, ethical, political), social identities (i.e., ethnicity, gender, class), or even with specific individuals and cooks (i.e., grandma, Anthony Bourdain). Bourdieu discusses how perceptions of taste are not linked to any particular qualities of things [foods] themselves, but that, "most products only derive their social value from the social use that is made of them (1984:21)." Thus, the ways we learn to value foods are largely based on our upbringing and socialization which allow us to discern what foods are valuable or appropriate to give or receive in "good taste" depending on the social situation.

Mary Douglas (1972) has argued that the meanings associated with meals are rooted in histories and traditions of meals consumed within the home. Each meal one consumes is symbolically associated with and builds upon the history of an archetypical meal. While Douglas emphasizes the role of special, festive meals in providing meaning for even, "the smallest, meanest meal (1972:67)," we might also consider how this might be inverted in some contexts. At times it may be that "grand meals" with respect to their size, structure, or their employment of special foods and equipment, gain their "additional meaning" via associations with everyday household meals (Dietler 2001: 69-70; see also Potter and Ortman 2004). The ethnographic literature is replete with examples where larger quantities, variations in the quality of preparations (i.e., more complex, finer processing, special flavors), or even the particular individuals involved in preparing and cooking each may lend foods their social value and/or place in special meals (e.g., Adapon 2008; Goody 1982; Hastorf 2016). Particularly for this study, ethnographic and archaeological research suggests that the foodstuffs and foodcrafts used to serve and consume foods were frequently the same both at communal feasts and daily household meals in the US Southwest (Cushing 1920; Mills 1999; Potter and Ortman 2004; Stevenson 1904; Van Keuren 2004; Wills and Crown 2004).

Comparatively examining histories of the foods, serving equipment, and spaces associated with both daily and special supra-household meals provides a critical source of information about both how foods become socially valued and how highly valued foods factor into broader processes of socioeconomic and political change (e.g., Crown 2018; Joyce and Henderson 2007; Mintz 1985; Wilk 2006). Both Matilda Cox Stevenson and Frank Hamilton Cushing living at Zuni in the early 1880s were firsthand witnesses to a rapid increase in the production of wheat and the consumption of increasingly elaborate forms of wheat bread both at daily meals and especially for public feasts (Cushing 1920: 556-559; Stevenson 1905:114, 274). Barbara Mills (2008) in discussing the adoption of wheat bread traditions at Zuni, argues that the shift in the values and symbolic associations of these breads following Spanish and American colonial contact was in part related to their distinctive visual properties as they were presented and served at large commensal events. We might often expect that changes in the symbolic associations or values of foods might occur in the context of public performance and the celebration of specific foods at ritual commensal events (Adapon 2008; Joyce and Henderson 2007; Mills 2007a). As such, examinations of both cuisine and commensality are critical.

Summary

If we were to list the "essential ingredients" of cuisine given the previous discussions, these might include: (1) shared cultural logics and rules surrounding appropriate foods and food behaviors, (2) culturally transmitted and embodied techniques and recipes, (3) specific core and local signature ingredients; (4) recognizable flavor combinations; and, (5) the necessary tools for combining, cooking, serving, and consuming foods. The first of the above listed "ingredients" is admittedly the most challenging to address archaeologically, and may largely be inaccessible in the absence of written records. However, the material remains of core ingredients, the flavoring agents, and the material traces of the bodily motions and the technologies used to prepare and serve foods make up much of the archaeological record (Chapter 4).

To understand the roles of food in processes of social change it is necessary to attend to both the broader social and environmental contexts and the particular mechanisms through which cuisines persist and change. While external political and environmental pressures are often important factors in cuisine change, a range of other social processes including the mixing of diverse populations and the construction of collective identities are also arenas where experimentation and innovation in cuisine might be tolerated or even encouraged. Moreover, changes in cuisine should also be considered with respect to commensality, especially in terms of understand how different foods become highly valued and produced and consumed at greater scales. In the Cibola region, where social transformations involved rapid population aggregation, settlement growth, and community formation, changes in cuisine are expected as networks of social interaction and teaching shifted, and as more collective forms of social identification and sociopolitical organization were established. As populations migrated and mixed, relatively unreflexive food practices in one context might have become sources of conscious social uncertainty and anxiety in another, as access to certain ingredients became more restricted and as newcomers faced pressures to conform socially within new communities (Chapter 3).

Commensality

The second conceptual lens I employ in this study is that of commensality, which links to and builds upon cuisine. If we view cuisine in terms of our food culture, then commensality can be considered the social nexus of food in our lives. Foodways, when examined in contexts of serving and consumption are highly symbolic, political, and socially expressive acts and forms of material culture (e.g., Bray 2003a; Crown 2000a; Dietler 2001; Dietler and Hayden 2001; Goody 1982; Gumerman 1997; Hayden and Villeneuve 2011; Joyce and Henderson 2007; Mills 1999, 2007a, 2016; Pollock 2012, 2013; Potter 2000; Sutton 2001; Wiessner and Schiefenhövel; Weismantel 1988; Warde 1997; Wilk 2006). The necessity, frequency, and social power of eating and drinking with others, both in daily household and special communal meals, makes this activity particularly relevant for studies of social and political change. Meals, when shared at supra-household scales are important arenas where we might expect food practices to be more actively involved in constructing, communicating, and negotiating social identities and political relationships. Studies of commensality highlight the political and economic dimensions of foodways and reveal ways in which daily food practices may reflect and participate in broader processes of social change (e.g., Dietler 1996, 2001; Dietler and Hayden 2001; Hastorf 2012, 2016; Hayden and Villeneuve 2011; Joyce and Henderson

2007; Maus 1980; Mintz 1985; Pollock 2012; Smith 2015; VanDerwarker et al. 2007; Weismantel 1988).

Setting the Table

Commensality is derived from the Latin (*com* "with") and (*mensa* "table") signifying the sharing of a meal at a table. In a similar fashion, a "companion" denotes someone with whom you eat bread (*pan* "bread"). As employed in biology, commensality refers to a symbiotic relationship where one party benefits and the other is unaffected. This potential disconnect between those serving or provisioning food and those acting as hosts and guests and sharing in the act of consumption, is an important aspect to keep in mind when considering the dynamic relationships between food and social life (see Pollock 2012). Materially, the sharing of meals involves a range of participants, materials (i.e., foods, utensils, decorations etc.), sensory qualities (e.g., aromas, visuals, acoustics, textures), and spatial settings. Conceptually, commensality interweaves production and consumption, food and performance, and individuals and society. The activities surrounding the serving and consumption of meals are grounded in the rules and behaviors of one's cuisine and society. In other words, the social and political significance of meals are rooted in part in the shared understandings of the histories and cultural logics or "grammars" of meals (i.e., Douglas 1972; Dietler 2001:69). At the same time, understanding the socioeconomic and political influence of commensal events also requires considering the bodily experience, social dynamics, and performance of meals (e.g., Appadurai 1981; Dietler 2001; Hamilakis 1999; Lalonde 1992; Mills 2007a). By examining commensality in this study, as opposed to focusing solely on feasts, my intent is to direct attention the important symbolic, social, and economic ties between daily foodways and special commensal events at range of supra-household scales.

In the following sub-sections, I outline some of the important links anthropologists and other social scientists have drawn between daily meals and the larger political economy, including the roles played by feasts and "commensal politics" in processes of social change. I first discuss the relationships between foods in daily meals and special commensal events and the political and economic importance of commensality. I then discuss meals-as-events (*sensu* Lalonde 1992), focusing particularly on supra-household commensal activities. In this section I discuss the relationships between commensality and the construction and communication of social identities. In particular, I highlight the importance of feasts as arenas of social and political practice and address the roles communal meals may play in processes of social integration and community formation.

Linking Domestic and Political Economies

Much scholarly work has addressed the social, economic, and political significance of commensality (e.g., Appadurai 1981; Counihan 1999; Dietler and Hayden 2001; Earle 1997, 2002; Goody 1982; Hastorf 2016; Hayden and Villeneuve 2011; Mauss 1980; Mintz 1985; Morehart and DeLucia 2015; Saitta and Keene 1990; Sahlins 1972; Spielman 2002; Warde 1997; Wilk 2006; Wolf 1982). While the preparation and sharing of food in daily meals is central to human social reproduction, socialization, and the construction of identity, supra-household meals play a special role in the establishment and maintenance of larger and more complex social and political relationships (Dietler and Hayden 2001a; Hayden and Villeneuve 2011; Wiessner and

Schiefenhövel 1996). In recent decades, studies of feasting have highlighted the complex relationships between feasting and economic intensification, the production of surplus, labor, power, status, and more indirectly to the emergence of political complexity and social inequality (Brumfiel 1991; Brumfiel and Robin 2008; Costin 1993; Crown and Fish 1996; Dietler and Hayden 2001; Hastorf 1991; Spielmann 2002). Even in relatively more egalitarian small-scale agricultural societies, increasing demands on household labor, specifically food and craft production, are often associated with ritual financing and feasting (Spielmann 2002). Although archaeological analyses of feasting recognize important connections between the political economy, communal food activities, and household food production practices, the relationships between these food activities are seldom explicitly addressed (see Brumfiel and Robin 2008).

This study of commensality builds upon theoretical models developed in anthropology that address the role of commensality in processes of social change (e.g. Appadurai 1981; Dietler and Hayden 2001a,b; Potter 2000; Spielmann 2002; Weismantel 1988; Wiessner and Schiefenhövel 1996). Feasting is notoriously difficult to define and operationalize archaeologically (see Dietler and Hayden 2001b). As such my goal here is not to deliberate on the specifics of what makes up a feast versus a daily meal, but to discuss the possible roles that large commensal meals and "commensal politics" might play in processes of aggregation and social coalescence. Despite disagreements concerning the definition of feasts, beyond defining them as communal consumption events, Michael Dietler and Brian Hayden (2001b) convincingly argue that studies of feasting are central to understandings of political life and processes of social change in the past. Hayden's studies of feasting emphasize the important relationships between feasts and the emergence of social and political complexity, distinguishing between different kinds of feasts based on their political agendas and underlying economic structures (1990, 1996, 2001; Hayden and Villeneuve 2011). Dietler (1990, 1996, 2001) orients his examinations of feasts and commensal politics around the *ritual* importance of such meals. Dietler's work emphasizes the significance of feasts as social arenas of practice involving a complex and at times contradictory array of actors, motivations, and struggles, both personal and ideological, for inclusion, power, representation, solidarity, and competition.

Cross-culturally, feasting practices and their material correlates are enormously varied; they may be marked by their unusual ingredients, the abundance of foods being served, associations with rituals or special life-events, by the number of participants, the use of special equipment, or the performative qualities of the meal (Dietler and Hayden 2001a). Ultimately, many studies of feasting draw an somewhat simplistic but still relevant distinction between feasts that predominately: 1) promote competition and create or sustain social differentiation, economic disparity, and rank (i.e., Dietler's "diacritical" and Hayden's "competitive" or "tribute" feasts); and, 2) feasts that promote cooperation and enhance social integration (i.e., Dietler's "empowering" or Hayden's "minimally distinctive feasts") (Dietler 2001; Hayden 2001). As is the case with discerning between daily meals and feasts, distinctions between these forms of feasts are typically made based upon the scale, participants, frequency, ritual associations, and the mobilization of resources involved in feasting activities, as well as the broader political and social context (e.g. Dietler 2001; Dietler and Hayden 2001b, Mills 2007a; Potter 2000). The northern U.S. Southwest offers both an interesting and challenging place to examine trajectories in commensality, as ethnographic and archaeological research suggest that the associations and similarities between the materials and meanings of daily and special communal meals were strongly emphasized. While communal ritual feasts were still covertly political (Mills 2007a; Potter 2000), it is likely that communal feasts in the Cibola region in the l4th century were contexts where social solidarity and shared collective ideologies were often communicated and emphasized.

The Power and Politics of Meals

The relative ability of individuals within a society to produce surplus and the nature of household and larger-scale institutionalized control over the distribution of labor and surplus have been longstanding topics of interest in studies addressing social stratification, inequality, and the emergence of political complexity (e.g. Earle 2002; Hayden 1990, 2001; Morehart and De Lucia 2015; Polanyi 1957; Sahlins 1972; Wolfe 1982). While archaeological studies of commensality and especially feasting acknowledge the high cost of funding these events in terms of labor, time, and resources, these analyses often focus largely on the activity and material traces of food consumption. To understand the economic and political importance of food and meals, however, requires careful examination of the organization, mobilization, and distribution of individuals, labor, technology, and relative "surplus" or "abundance" (*sensu* Smith 2017) involved in producing, storing, preparing, and supplying foodstuffs for these special commensal events (e.g., Barrier 2011;Blitz 1993; Brumfiel 1987, 1991; Foxhall and Hastorf 2017; Hastorf 2016; Klarich 2010; Gumerman 1997; Morehart and de Lucia 2015; Saitta and Keene 1990; Smith 2015; Spielmann 2002; Warde 1997). In short, to understand the social and political dynamics of feasts requires examining the extent to which individuals, households, and larger institutions were involved in, and credited, with producing, preparing, and otherwise financing these commensal events.

At a meal, whether small and ordinary or large and extraordinary, the types or quantities of food being served or the order in which one is served may each mark one's relative social status and standing within a family or larger community (e.g., Cushing 1920: 536-537; Weismantel 1988: 179-182). Arjun Appadurai describes the often subtle social and political dynamics and manipulations of daily meals as "gastro-politics" (1981). While everyday meals have the potential to communicate social, symbolic, and political messages, feasts require particular attention because, despite their cost, hosting and/or providing food for large commensal events is often an important arena for displaying, accruing and/or contesting political power, economic ability, and social status in every society, from hunter-forager groups to highly stratified state societies (e.g., Adapon 2008; Bray 2003; Dietler and Hayden 2001; Hayden 1990, 2001; Potter 2000; Smith 2015; Wiessner and Schiefenhövel 1996). Michael Dietler refers to this special social and political potential afforded by feasts as "commensal politics" (2001). Feasts may produce or strengthen social and political ties. Hosting, funding, and otherwise participating in feasts may be a source and/or expression of political power, control over resources (e.g., Dietler 1990, 2001; Dietler and Hayden 2001; Hayden 1990, 2001; Rappaport 1984; Strathern 1969), or particularly in the case of the US Southwest of ritual knowledge and authority (Potter 1997b, 2000; Spielmann 2002).

Food Gifts, Commodities, and Capital

The idea of a gift economy has been highly influential in how we understand the dynamics of preindustrial political economies and especially the symbolic and political power of communal commensal events. In *The Gift,* Marcel Mauss (1980) describes several economic systems organized around reciprocal exchange relationships such that the act of giving itself imbues objects, very often foodstuffs, with special social and political significance. In some cases gifts of food might literally be seen as receiving and incorporating the "essence" or personhood of the one who prepared the food. At the same time, the event of sharing and incorporating gifts of food sets a memorable precedent or social contract for future (delayed) exchanges in kind. In short, the exchange of gifts, particularly of food, acts as a foundation for enduring social networks. It conveys both a sense of social inclusion or solidarity, as well as shared understandings about social status between guests and hosts and obligations for future reciprocal exchanges. Even today, the importance of reciprocal exchange may also be understood more generally as a key social dynamic underlying modern collectivist-oriented groups and promoting acts of volunteerism (e.g., Eckstein 2001). Given this important overlap between commensal politics and gift economies, the sharing and exchange of foodstuffs, particularly at supra-household scales, should be of central interest when examining processes of population aggregation and community formation.

Pierre Bourdieu's (1986) theories concerning capital have also often been employed to understand relationships between food and the society. Bourdieu outlines how economic capital can be converted or transformed into social and symbolic capital, allowing for the enhancement (or reduction) of one's power and status and the establishment of social relationships. At the same time, one's social standing and network of social relations can also be leveraged or converted into economic capital, potentially allowing one access to needed resources. When applied to the pre-contact US Southwest, these concepts in part help to explain some of the potential costs and benefits of participating in ceremonial feasts and maintaining social membership within and outside of one's immediate community. To a degree, community membership would be beneficial to individuals and households, particularly those experiencing periods of scarcity, as they could rely upon extensions of neighborly or kin-based hospitality and reciprocity (Hegmon 1991, 1996) as well as the on the public, communal redistribution of food at feasting events (e.g., Ford 1972; Stevenson 1904). On the other hand, households in communities that emphasize egalitarianism and social participation through the communal sharing of food might also regularly experience heavy social demands placed upon resources (Twiss and Bogaard 2017). Finally, more distant social ties outside of one's immediate community could also be called upon if conditions of food shortage forced the temporary abandonment of one's home (Cushing 1920:77-79; Zuni People 1972: 38, 68). Each of the above strategies would have reinforced the importance of social interactions surrounding food and have been important for ensuring food security given the variability of precipitation and annual agricultural success in the US Southwest (e.g., Cordell et al. 2007; Lightfoot 1979; Minnis 1985; Nelson et al. 2015).

Meals-As-Events, Meals-as-Experiences

Earlier in this chapter I discussed the frequent association between cuisine and the construction of social identity. In this section on commensality and the performance of meals, I am interested in exploring different contexts and mechanisms through which social identities are constructed, expressed, or negotiated in commensal events. The act of consuming or incorporating food and drink is well understood to play an important role in the construction and reinforcement of identity, memory, and social bonds, particularly at larger social and political scales. Foods can be powerful semiotic devices, expressing many layers of social information through their serving and consumption. “In its tangible and material forms, food presupposes and reifies technological arrangements, relations of production and exchange, conditions of field and market, and realities of plenty and wants (Appadurai 1981: 494).” It is the sensory qualities of consuming foods that make it a powerfully memorable act (Adapon 2008; Holtzman 2006; Sutton 2001), with the physical nature of food incorporation and embodiment reinforcing the symbolical power of foodstuffs (Dietler 2001; Hamilakis 1999).

While meals, especially feasts, have often been examined and characterized by functional, structural types, Marc Lalonde argues for moving analyses of meals beyond narrow views of “meals-as-objects,” and instead engaging more broadly with “meals-as-events” or “meals-as-lived-experience” (1992: 70-71, 75-76; see also Rosemary and Joyce 2007:650). This framework of meals-as-events is useful on two levels. First, it pushes us to think about meals as more than discoverable, static classes of materials by considering the dynamic bodily and social experience of meals. I would argue this way of thinking about meals is particularly useful in archaeological investigations of food. Without historic or other visual references, it is easy to overlook how meals, represented by fragments of bowls and bones, were fragrant arenas full of social action. Feasts in particular are central arenas for communicating social and ideological messages, for encouraging solidarity and/or competition, and involve a dynamic range of other practices and interactions between a numerous actors and foodstuffs (e.g., Dietler 2001; Hamilakis 1999). Secondly, “meals-as-events” or “experiences” encourage us to consider meals as activities, or more accurately sets of interrelated activities (i.e. production, preparation, cooking, consuming, and tidying up) as well as networks of actors, labor, time, and places with very real economic and political consequences. Pollock (2012) raises an important point concerning the need to consider possible asymmetries between those whose labor is required to fund a feast and the social and political benefits gained by those participating as hosts or participants (i.e., biological commensalism) (see also Adapon 2008). In periods of rapid population aggregation and settlement nucleation, we might often expect some degree of reorganization in the nature and intensity of food activities especially as the political complexity of communities increased and households groups participated and invested more heavily in communal rituals (Spielmann 2002). I return this this in the final section of the chapter.

Ideas about food and eating are linked to ideas of self, place, and history. The symbolic potency of ingesting food with others often provides a sense of shared identity and solidarity (Counihan 1999, 2004; Dietler 2001; Mauss 1980). Some cultures understand shared acts of consumption as acts of social unification, as is the case with the Hua of Papua New Guinea where eating together involves literally sharing in the same physical and "vital essence" (Meigs 1988). Sharing in the act of consuming food creates a memorable bond between hosts and guests even if guests are socially distant or even considered hostile in other social contexts. During his stay at Zuni Pueblo, Cushing describes several encounters where food was given to visiting Navajos as an extension of household hospitality and ceremonial exchange during *Sha*'*lak*'*o* (1920: 529-534, 607-608).

As a meal is shared and consumed, foodstuffs and table manners can both accentuate or minimize social differences between people. Signature foods and ingredients are often considered as metaphors of the self, and the provision or consumption of these foods constitutes an important signal or condition of group inclusion. “Food preferences are close to the center of…self-definition: people who eat strikingly different foods or similar foods in different ways are thought to be strikingly different, sometimes even less human (Mintz 1985: 3).” The act of eating can reveal shared social identities and ideologies or express a desire for membership and social inclusion, while refusing offers of foods can signal a rejection (e.g., Cushing 1967:90-91; Ohnuki-Tierney 1993). Other forms of social identity within a society (e.g., gender, age, status, reputation) may also be communicated during a meal by who gets how much of what kinds of food, the order of serving, the containers used, or seating arrangements etc. (Appadurai 1981; Cushing 1920: 519; Dietler 2001; Twiss 2012).

In summary, food sharing, meal structures, and even the material culture surrounding consumption are powerful media or “embodied material” that have an important role in constructing and communicating social identities and relationships. Gifts and exchanges of foodstuffs can create or reinforce reciprocal ties and as well as masking or legitimizing a variety of political and economic strategies under a cloak of altruism (Bourdieu 1977: Dietler 2001; Hamilakis 1999). This understanding of the role of foodstuffs as communicators and social motivators in the context of a meal adds nuance to models of food choice and production. At times social factors or particular political contexts might necessitate abstaining from desired foods in order to impress a guest or mask social differences (Cushing 1979:90; Wilk 2006). In other circumstances producing and sharing valued foodstuffs for large commensal events can be politically advantageous but potentially economically ill-advised or environmentally unsustainable for households or communities over time.

Summary

To understand the roles of food in periods of social transformation it is important to examine contexts of food serving and consumption, and to ask how these activities may have shifted in scale, frequency, or inclusivity over time. The activities surrounding the sharing, serving, and consumption of food and meals are closely linked to processes of social integration, political negotiation, and identity construction, especially at larger social scales. Addressing commensality in the past requires examining the social ties between daily meals and special commensal events, and examining how greater participation and investment in commensal events factored into household food production, storage, and preparation practices. Examining the nature and organization of daily foodways in relation to special commensal occasions through time provides a unique window into histories of cuisine and how foods become more or less valued in different political and socioeconomic circumstances. Finally, understanding the socioeconomic and political importance of commensal events in periods of social change requires considering the bodily experience, social dynamics, and performance of meals.

Foodways and Transformations in the Scale of Social Life

As I discussed in the previous sections on cuisine and commensality, foodways play an important role the construction and communication of social relationships and identities at larger social scales. While the far-reaching political and economic outcomes of population aggregation and migration have often been emphasized, few studies have explicitly addressed the interplay between aggregation and foodways. Particularly in terms of economic intensification, little work has examined how this process involved and influenced household and communal-scale food production and consumption practices. In the remainder of this chapter, I consider how foodways might participate in and be shaped by these social transformations. I briefly review the recent literature on population aggregation, coalescence, and urban scaling theory and provide some general expectations concerning the socioeconomic challenges and opportunities for aggregating and coalescing communities. Throughout this section I focus on how foodways, specifically food production and consumption behaviors, might be interact with increases in settlement size, density, and social diversity, ideas further developed in Chapter 3.

Population aggregation and coalescence have often been associated with significant interrelated political, social, and economic transformations at both local and regional scales (e.g., Bettencourt 2013; Bettencourt et al. 2007; Carballo 2012; Hill et al. 2004; Johnson 1982, 1983; Kowalewski 2006; Price and Feinman 2010). In small-scale societies, episodes of aggregation often result in the development of new political and ritual institutions to facilitate cooperation, manage resource access and distribution, and otherwise reduce scalar stress (e.g. Adler 1996b; Bernardini 1996; Fish and Fish 2015; Kosse 1990; Johnson 1982, 1983). In the US Southwest, widespread aggregation in the 13th century increased both the number of family units within individual settlements and dramatically altered the distribution and size of communities at a regional scale, changes that broadly reorganized the social landscape and reshaped social networks within and between regions (e.g. Kintigh et al. 2004; Peeples 2018; Mills et al. 2015). In this study, the processes of aggregation and settlement nucleation represent instances of abrupt or episodic social transformation, as opposed to more gradual kinds of social change (see Hegmon et al. 2008).

As used in this study, coalescence refers to the social processes through which previously distinct (and often socially diverse) populations come together and integrate rapidly into a single, socially cohesive community (see Kowalewski 2006; also Birch 2013a). Cross-cultural and archaeological studies suggest that periods of coalescence are periods of social flux and innovation that frequently entail social reorganization, economic intensification, the restructuring of the political economy, and the development of new integrative social institutions (e.g., Birch 2013b; Feinman 2011; Kowalewski 2006, 2013; Whiteley 1988). Both aggregation and coalescence often involve a degree of migration, which in some contexts brings people with different cultural and historical backgrounds into close proximity with one another. In the US Southwest, migrations have often been linked to episodes of dramatic social change and community reorganization (e.g., Bernardini 2005; Cordell 1995; Hill et al. 2004; Ortman 2012).

The Opportunities and Challenges of Scaling Up

Population aggregation and settlement nucleation are processes that have been associated cross-culturally with lasting political, social, and economic transformations (e.g. Bettencourt 2013; Carballo 2012; Johnson and Earle 2000; Price and Feinman 2010*)*. Studies of aggregation and community formation highlight the social and political dynamics and processes through which groups adjust to life at larger social scales. Especially in the context of small-scale societies, studies of settlement and regional scale aggregation provide important opportunities to examine processes of self-organization, social integration, and the emergence and response to the creation of new social institutions (e.g., Carballo 2012; Carballo et al 2014; Feinman 2011; Kohler et al 2004;

Peeples 2018; Schachner 2010). Newly aggregated groups face a myriad of interrelated challenges and opportunities surrounding: (1) the need to reduce density-dependent communication and information processing stress (i.e., scalar stress) (e.g., Dunbar 1992, 1998; Johnson 1982, 1983; Kose 1990); (2) the balance between social competition and cooperation (e.g., Carballo 2012; Carballo et al. 2014); (3) the development or reorganization of social institutions and integrative mechanisms to manage groups of greater size and often greater social diversity and political complexity (Kowalewski 2006; Hegmon et al. 2016; Spielmann 2002); and (4) the development or reorganization of institutions and norms regulating resource management and distribution (e.g., Adler 1996b; Fish and Fish 2015; Ford 1972; Stone and Downum 1999). Each of these topics is addressed below.

As people aggregate and begin to live together in larger, denser settlements, the number of social interactions between non-kin individuals (i.e., relative strangers) increases in frequency. Density-dependent social stresses arise from increasingly large and more complex networks of social interaction and information exchange (Dunbar 1992, 1998; Johnson 1982, 1983; Kosse 1990). Cross-culturally, levels of social or scalar-stress become critical issues for sedentary populations above 250-500 individuals (Feinman 2011; Johnson 1982; Kosse 1990). Beyond this population threshold more formal and complex social mechanisms become vital for integrating and organizing social groups, or the group will likely fission (e.g., Bernardini 1996; Whiteley 1988). As such, we might expect that the development of integrative communal ideologies and ritual practices in small-scale societies often centered on the sharing of special foods and feasting activities (Spielmann 2002).

Even with the challenge of managing higher levels of social stress, there are also social and economic advantages to life in large, densely networked communities. Recent work on urban scaling theory suggests that economic developments, increased productivity, and specialization are closely tied to increases in interaction frequency and social interconnectedness (Bettencourt 2013; Bettencourt et al. 2007; Bettencourt et al. 2010). In short, this work demonstrates that as the population of a village or city grows, the output of that city along a broad range of economic indicators (e.g., agricultural production, luxury items, household wealth) increases at a rate faster than 1 to 1 and that certain infrastructural indicators (e.g., the number of paths, public structures, etc.) tend to grow at a slower than 1 to 1 rate, suggesting increasing efficiency. While urban scaling theory developed from observations on the average properties of modern cities, similar findings have been documented using historic and archaeological settlement data (e.g., Cesaretti et al. 2016; Ortman et al. 2014; Ortman et al. 2015; Ortman et al. 2016). Importantly, Scott Ortman and Grant Coffey (2017) have argued that certain economies of scale can be observed even in middle-range societies drawing on data from aggregated villages in the Mesa Verde region. Overall, this model suggests that you can get increasing returns on investments of labor in larger populations and that this likely would have been a perceived benefit of increasing community size.

As groups grow in size the reorganization or creation of new decision-making and leadership institutions is critical to reduce scalar stress and to negotiate other sources of communal tension. There is a rich history of scholarship in the US Southwest that has addressed relationships between aggregation, settlement size, and organizational complexity (e.g., Adams 2002, Adler 1996a; Bernardini 1996; Duff 2002; Kintigh 1994;

Kintigh et al. 2014; Lowell 1996; Rautman 2013; Stone 2000). There is little evidence that prehispanic populations of nucleated settlements in the 13th and 14th centuries often exceeded the threshold of roughly 2,500 individuals associated cross-culturally with more hierarchical forms of political organization (Feinman 2011; Johnson 1982, 1983; Kose 1990). Instead more social organization and governance took more egalitarian and corporate forms (i.e., clans, sodalities) (e.g., Feinman et al. 2000; McGuire and Saitta 1996; Peregrine 2001; Schachner 2010). More broadly, collective leadership is amongst Kowalewski's (2006:117) list of core cross-cultural traits observed in coalescent societies. This suggests that the process of aggregation in the Cibola region would likely have involved some shift from household to supra-household scale decision-making and power concerning issues of labor, land, and other ritual and economic resources. This process of social and political reorganization would necessarily involve numerous meetings of various kinds, events that likely would often center around a shared meal (Cushing 1920; Potter 2000; Stevenson 1904).

Another important element in the creation and maintenance of successful large groups and for enjoying the benefits of collective cooperation (i.e., defense, labor, food-security, etc.) involves managing tensions over diminished privacy and increased social diversity by fostering shared collective social identities or "imagined communities" (e.g., Bernardini 1998; Carballo 2012; Carballo et al. 2014; Hegmon et al. 2016; Isbell 2000; Kosse 1990; Peeples 2018). The reorganization and intensification in ritual and/or ceremonial activities in U.S. Southwest in the late 13th century has often been linked to the need to socially integrate aggregating populations (e.g., Adams 1991; Crown 1994; Kose 1990; Potter 2000; Mills 2004; Spielmann 2002). As such, we might expect ceremonial feasting and household investments in provisioning them to similarly increase through time. Katheryn Twiss and Amy Bogaard (2017) drawing on patterns of food storage and feasting at Çatalhöyük, have argued that public, ritual exchanges of food would have served as a way to redistribute food resources and level perceived economic disparities in aggregated egalitarian societies (see also Bogaard et al. 2009; Ford 1972). Finally, while Kowalewski's study of coalescent societies focused on instances of rapid aggregation and social integration, in the US Southwest this process of forging social communities and collective identities may at times have been a slower process, especially when aggregation involved the mixing of local groups with more distant migrants (see Hegmon et al. 2016; also Chapter 3).

Much of the archaeological evidence for social integration in the U.S Southwest derives from changes in the built environment (e.g., the construction of central plazas). While feasting had long occurred in more private smaller-scale ritual spaces (i.e., kivas) (e.g., Blinman 1989; Potter 1997b), large plazas with high visibility constructed in the late 13th century would have played a key role in strengthening collective, communal identities and in structuring and increasing the efficiency of flows of people, goods, and services (e.g., Dungan and Peeples 2018; Bettencourt 2013; Kuijit 1999). Furthermore, hosting and participating in feasts in these spaces would have involved novel visuals and social dynamics in terms of the serving and distributing food at feasts (Mills 2007a, 2008; Van Keuren 2004). The presence of distinctive feasting foods, such as the *piki* bread discussed in Chapter 1, would both have served to highlight the significance of these social events and to communicate and reinforce communal ideologies and understandings of place. As previously discussed, producing abundant and highly valued foods for feasts would have economic implications for households as the desire to participate in public feasts would place new demands on household surplus food and labor. Ultimately, the "cost" of participating and integrating into larger coalescent communities may often have involved additional economic burdens and some decrease in household autonomy (Adler 1996b; Bernardini 1998).

Finally, aggregating communities must face the complex task of negotiating resource access and distribution to deal with new subsistence pressures and increased competition over resources like local arable land and hunting rights (e.g., Adler 1996b; Fish and Fish 2015; Potter 1997; Stone and Downum 1990). At the same time, one of the draws of life in large nucleated towns may have involved benefiting from the greater efficiency and productivity of larger cooperative labor groups in building and maintaining settlement and agricultural infrastructure (Adams and Duff 2004b; Bowannie et al. 1994; Ortman et al. 2015). Cross-cultural and archaeological research suggests that the relationship between population size, use-rights, labor investment, mobility, and the availability of arable land are highly complex (e.g. Adler 1996b; Anderies 2006; Carballo 2012; Nelson et al. 2010). Depending on requirements for labor, recruitment, or other social needs, land tenure and resource access in the prehispanic northern US Southwest would likely have been negotiated simultaneously at household, communal, and intra-communal levels (Adler 1996b:339; Bowannie et al. 1994; Cushing 1920). Histories of settlement occupation and landscape use are also an essential factor; longer periods of access tend cross-culturally to increase labor investment, especially in regards to landesque capital (e.g., terraces, irrigation canals, rock gardens) which in-turn influences productivity and the size of the group with primary access (Adler 1996b: 142-143).

Histories of dense occupation are often important factors associated with the use and availability of fuel resources (e.g., Kohler and Mathew 1988) and even more critically on the population dynamics of local game (e.g., Schollmeyer and Driver 2013).

Summary

Population aggregation and coalescence are complex processes that provide groups with novel social, political, and economic challenges and opportunities. Increases in settlement size, density, and often social diversity are associated with increasingly complex flows of information and tensions concerning leadership organization and resource access and distribution. At the same time as settlements grow and individuals become increasingly interconnected and integrated, larger cooperative groups benefit in terms of added defense, marriage partners, and increased economic productivity and specialization. A degree of intensification and reorganization of food production to feed larger populations and to fund social integrative institutions (feasts) might often be expected with population aggregation in small-scale societies. Increases in the size and formality of public feasting events might also be expected to result in the innovation and/or increased production of special foods meant to commemorate and celebrate particular places, collective social ideologies, and communal identities.

Chapter Summary

The centrality of food in the making and maintenance of social relationships at multiple social scales makes foodways important to our understanding of how past societies related to and through food in periods of social change. To understand how foodways played a role in and where shaped by social transformations in the past, archaeological analyses benefit by engaging more with the social dimensions of food.

Studies of cuisine and commensality provide a unique view into social and political processes that can be used to address the complex relationships between broader changes in the environment and political economy and the daily practicalities that shaped daily food practices in the past. Several of the aspects of cuisine and commensality discussed in this chapter are challenging to address directly archaeologically, others however, can be accessed through the careful use of multiple lines of archaeological evidence, ethnographic and historic records, and ethnoarchaeological research (Chapter 4). In Chapter 3, I present the details of the Cibola case study and discuss the specific research objectives and questions that guide the comparative analyses of cuisine and commensality in the remainder of the dissertation.

Chapter 3:

SOCIAL TRANSFORMATIONS IN THE CIBOLA REGION

The Cibola region provides an ideal context to examine and compare relationships between foodways and processes of rapid social change involving population aggregation and social coalescence. For over a century, the Cibola region and modern Zuni Reservation have been the focus of ethnographic, historical, and archaeological research concerning matters of subsistence, social identity, sociopolitical organization, and processes of population aggregation, migration, and settlement growth and nucleation (e.g., Bohrer 1960; Cushing 1888, 1920; Danson 1957; Duff 2002; Ferguson and Mills 1987; Huntley 2008; Gregory and Wilcox 2007; Kintigh 1985, 1996; Kintigh et al. 2004; Martin et al. 1962; Muenchrath et al. 2002; Peeples 2018; Roberts 1932; Schachner 2012; Smith et al. 1966; Spier 1917; Watson et al. 1980).

In this study, I draw upon extensive collections of archaeological materials and legacy data from across the Cibola region to compare patterns in cuisine and commensality both temporally and spatially across three settlement clusters: the Central Zuni, El Morro Valley, and the Upper Little Colorado areas (Fig.3.1). While populations aggregated in each area, the process differed across the region with respect to the extent of demographic growth, the pace of this process, and the degree to which it involved the incorporation of local populations versus more distant migrant groups. In this chapter I begin with a general overview of the Cibola region, both as an archaeological construct and as a physical landscape. I then provide a summary of Cibola paleoenvironmental and settlement history, focusing on recent research on 13th and 14th century social transformations. Finally, I discuss the specific research objectives and questions that guide the remainder of this work.

The Cibola Region: Boundaries and Chronology

The Cibola region is roughly bounded in the periods examined here by the confluence of the western Puerco and the Little Colorado River, the Mogollon Rim to the south, and the Zuni Mountains and Continental Divide to the north and east (Fig.3.1). While populations in the Cibola region were concentrated into six large towns along the Zuni River by the time of the Spanish *entrada* in A.D. 1540, settlements were widely distributed throughout portions of east-central Arizona and west-central New Mexico in the preceding centuries. I follow previous regional-scale archaeological studies in defining the Cibola region based on the distribution of Cibola White Ware ceramics (e.g., Duff 2002; Duff and Schachner 2007; Gregory and Wilcox 2007; Kintigh 1996; LeBlanc 1989; Peeples 2018). Designations of the major settlement areas or sub-regions discussed and compared in this study also follow previous research conventions (see Adams and Duff 2004b; also Duff 2002; Huntley 2008; Kintigh 1996, 2007; Peeples 2018; Schachner 2012).

The temporal periods used to compare settlements over time follow a slightly modified Pecos classification (i.e., Kidder 1927). This does not change the dates associated with the Pueblo II period (A.D. 900-1150), however the dates for the Pueblo III or post-Chacoan era (Fowler and Stein 1992; Kintigh 1994, 1996) are slightly adjusted to span A.D. 1150-1275 (as opposed to A.D. 1150-1300). This modified Pecos classification better accounts for the overwhelming evidence for an earlier transition to nucleated pueblos in some portions of the Cibola region prior to A.D. 1300, a key shift in settlement patterns associated with the Pueblo IV period across the U.S. Southwest (Adams and Duff 2004b:3-5; Kintigh 1996; Schachner 2007).

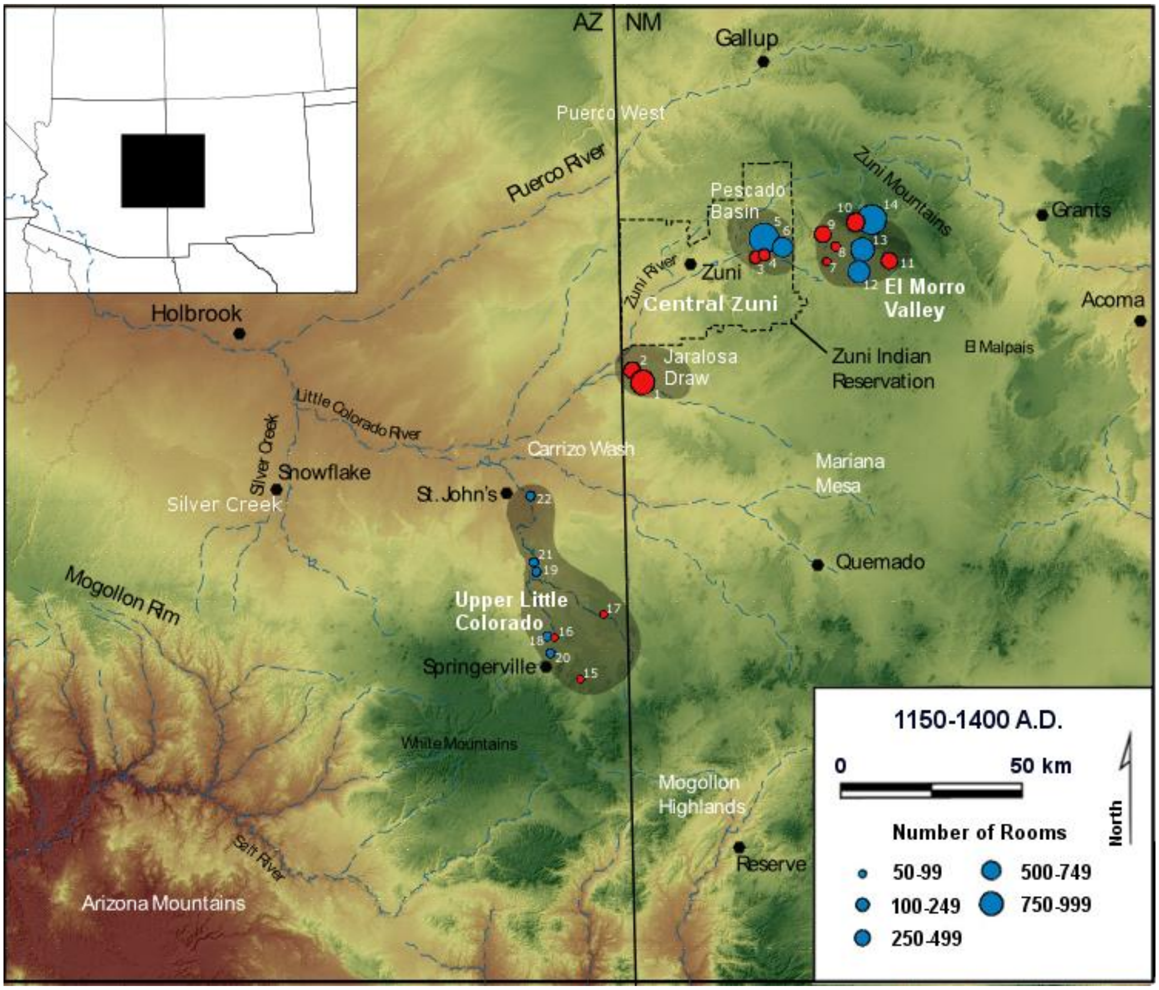

Figure 3.1. Map of the Cibola Region Showing Main Settlement Areas, Core Pueblo III (red) and Pueblo IV (blue) Period Sites, and Major Geographic Areas Referenced in this Study (adapted from Peeples 2011, Fig. 3.2.).

From north to south, Cibola settlements have traditionally been divided into one of two major prehispanic cultural areas of the U.S. Southwest, the northern Ancestral Puebloan (previously Anasazi) and the southern Mogollon (Peeples et al. 2017). These archaeological divisions are based in part on persistent differences across multiple classes of material culture (i.e., the production of brown versus gray ceramic utility wares; the construction of circular versus square kivas). However, it is unlikely that these archaeologically defined regions mapped meaningfully to the scale at which individuals and communities regularly interacted or construed social identities in the past (e.g., Hegmon 2000; Kintigh 2007; Peeples 2018). Previous archaeological work in the Cibola region suggests that the location and permeability of social identities and boundaries varied greatly over time and at both regional and sub-regional scales in the periods examined in this study (e.g., Duff 2002; Hegmon et al. 2016; Huntley 2008; Kintigh 2007; LeBlanc 1989; Peeples 2018; Schachner 2012). Extensive research concerning the production and exchange of ceramic vessels suggests that a degree of population circulation and interaction persisted between the northern and southern portions of the Cibola region at least into the late 12th and early 13th centuries (Duff 2002; Huntley 2008; Mills 2007b; Mills et al. 2013; Peeples 2018; Schachner et al. 2011).

The Physical Cibola Landscape

Situated along the southeastern edge of the Colorado Plateau the topography of the Cibola region varies widely creating a diverse landscape of broad, flat stream valleys, adjoining mesas, and steep-walled canyons. The landscape slopes broadly from about 1600 m in the west to over 2200 m in the Zuni and White Mountains. The region encompasses a range of environments including large swaths of pinyon-juniper woodlands (Great Basin Conifer Woodlands) as well as patches of more open mixed savannah-wood, shrub, and grasslands (Plains and Great Basin Grassland). Along permanent waterways and springs dense riparian vegetation including cattails (*Typha sp.*), cottonwood (*Populus sp.*), and willow (*Salix sp.*) can be found.

While characterized as having a semiarid climate, the amount of annual precipitation varies greatly across the Cibola region (Ferguson and Hart 1985:12-13). Summer monsoons are essential for crop growth and maturity, while winter precipitation provides a critical source of water for maintaining alluvial water tables and providing sufficient soil moisture for germinating seedlings after planting (Miller and Larson 1975; Muenchrath et al. 2002; Van West and Greenwald 2005: 1.17-1.19). Much of the Cibola region lies along the edge of a continually shifting border between areas with two different patterns of annual rainfall: a western bimodal, summer-winter dominated area; and a more eastern unimodal, summer-dominated precipitation region (Cordell et al. 2007; Dean 2007). These variable precipitation patterns and the practice of a high degree population circulation (see Schachner 2012) are thought to have made Cibola populations living in these areas relatively more resilient to periods of drought and climatic instability (Borck et al. 2015; Dean 2007:89).

Annual precipitation for the best arable areas of the Cibola region ranges from 280-430 mm (Kintigh 1985: 92-93), with somewhat greater amounts of winter precipitation to the north and west. Areas with higher elevation (i.e., lands adjacent to the White and Zuni Mountains) generally receive more rain; however, as these same areas are cooler, farmers face a more constricted growing season and a greater associated risk of losing harvests to frost both at the time of planting and harvest (Dean 2007; Ferguson and Hart 1985:15; Mills and Larsen 1975). The low average annual rainfall of the Cibola region suggests that successful agriculture generally requires supplying crops with supplemental sources of water (Kintigh 1985:99; Damp 2007; Muenchrath et al. 2002). Ethnohistoric and archaeological studies have documented at least 3000 years of successful agriculture across the Cibola region and Zuni Reservation involving a diverse mixture of water and soil management strategies (i.e., terraces, check dams, *ak-chin*, spring and stream canal irrigation technologies) (e.g., Cushing 1920: 152-215, 364-377; Damp 2007; Damp et al. 2002; see also Chapter 5).

Table 3.1. Core Sites Included in Study.

Map Ref. No.	Pueblo Period	Site Name	Site Number	Occupation Period (A.D.)	Est. No. Rooms	Approx. No. Excavated Rooms[1]	References
			Central Zuni				
1	PIII	Hinkson	LA 11439	1200-1275	560	8	Kintigh et al. 1996
2	PIII	Jaralosa	LA 3993	1200-1280	120	0	OBAP Notes
3	PIII	NA 11527	NA 11527	1250-1275	10	10	Zier 1976, 1983
4	PIII	NA 11530	NA 11530	1250-1275	30	25	Zier 1976, 1983
5	PIV	Heshot uła	LA 2114	1270-1385	875	4	Kintigh et al. 2004
6	PIV	Lower Pescado Village	NM: 12:13:109	1300-1400	420	4	Rothschilde and Dublin 1995
			El Morro Valley				
7	PIII	LA 132353	LA 132353	1250-1275	9	9	Howell 2004
8	PIII	Los Gigantes	LA 56159	1240-1280	60	9	Schachner 2012
9	PIII	Pettit	LA 1571	1225-1300	154	67	Saitta 1994
10	PIII	Scribe S	LA 59321-56	1240-1275	410	34	Watson et al. 1980
11	PIII	Tinaja	NM:12:G3:99	1250-1290	163	7	Watson et al. 1980
12	PIV	Atsinna	NM:12:G3:121	1275-1385	875	15	Watson et al. 1980
13	PIV	Mirabal	NM:12:G3:97	1275-1325	740	9	Watson et al. 1980
14	PIV	Pueblo de los Muertos	NM:12:G3:20	1260-1350	880	17	Watson et al. 1980
			Upper Little Colorado				
15	PIII	Rudd Creek	AZ Q:16:63	1250-1325	50	12	Clark et al. 2006
16	PIII	Rim Valley	AZ Q:15:73	1150-1250	10	9	Martin et al. 1962
17	PIII	Coyote Creek	AZ Q:16:3	1200-1300	30	28	DeGarmo 1975
18	PIV	Hooper Ranch	AZ Q:15:6	1275-1350	60	21	Martin et al. 1961, 1962
19	PIV	Baca Pueblo	AZ Q:11:74	1275-1380	90	7	Duff 2004
20	PIV	Casa Malpais	AZ Q:15:3 ASM	1275-1325	48	7+	Danson and Malde 1950
21	PIV	Rattlesnake Point Pueblo	AZ:Q:11:118	1325-1380	85	31	Duff 2004; ULCPP Notes
22	PIV	Table Rock	AZ Q:7:5	1325-1400	85	50	Martin and Rinaldo 1960

[1]Does not reflect the number of units placed in extramural plaza, midden, or other test excavation contexts

The three core settlement areas examined in this study are the Central Zuni, El Morro Valley, and Upper Little Colorado areas. The Central Zuni and El Morro Valley are located in the northern/northeastern portion of the Cibola region, while the Upper Little Colorado area spans the modern Arizona-New Mexico border to the southwest

(Fig.3.1). Table 3.1 provides a full list of the sites for each settlement area and period that form the analytical core of this study. The Central Zuni sub-region considered here includes the Zuni river drainage, surrounding Pescado Basin, and the Jaralosa Draw area to the south and west of the modern borders of the Zuni reservation (e.g., Huntley 2008; Huntley and Kintigh 2004; Kintigh 1996, 2007). The Zuni River Valley and surrounding northern Cibola landscape are characterized by open valley bottom grasslands and surrounding mesas topped with pinyon-juniper woodlands and interspersed with deeply incised canyons (Ferguson and Hart 1985:17). Southwest of the Zuni River Valley, the Jaralosa Draw has a somewhat more extensive grassland covering.

Directly east of the Zuni reservation, the El Morro Valley lies between the Zuni Mountains and a surrounding series of tall mesas that form its southern and eastern boundaries. Much like the Pescado Basin, grassland and pinyon-juniper communities dominate upland areas in El Morro Valley. While the higher elevation and proximity to the Zuni Mountains provide reliable access to abundant upland plant resources and artiodactyl and wild turkey populations, the growing season in the El Morro Valley is on average only 113 days, roughly a month shorter than the average growing season recorded for Zuni Pueblo (150 days) (Kintigh 1985:93).

The Upper Little Colorado area lies in the southwestern portion of the Cibola region. The Little Colorado River is a tributary of the Colorado River with its headwaters in the White Mountains. The river channel is generally narrow and shallow and it forms a north-south running band of lowland riparian communities accessible to a series of restricted valleys. Areas outside of the Little Colorado River and its tributaries are characterized by arid, open grasslands interrupted by basalt badlands and sporadic small pockets of upland woodlands (Duff 2002:63-65). Elevations in the Upper Little Colorado area decrease as one moves north away from the White Mountains towards the confluence of the Little Colorado River and the Puerco River of the West. As with the El Morro Valley, settlements situated at higher elevations near the White Mountains benefit from higher annual precipitation and denser plant and animal resources but at the expense of more restricted growing seasons. The average growing season for Springerville is only 110 days, while St. Johns, less than 50 km to the north, averages 140 days (Miller and Larsen 1975:60).

Population Aggregation and Settlement Nucleation A.D. 900-1400

Pueblo II: A.D. 900-1150

The Pueblo II period in the Cibola region is characterized by the transition from subterranean pit structures and seasonal residential mobility to masonry roomblock pueblos and year-round sedentary habitation (Peeples et al. 2012). As such, the settlement patterns established in this period provide the historical foundation or context (i.e., Pauketat 2001; Stahl 2002) for the dramatic shifts in settlement and social organization documented in the Pueblo III and IV periods. For understanding different trajectories in cuisine and commensality, this period serves as a useful point of entry from which to understand and compare subsequent developments in the foodways of sedentary agriculturalists across the Cibola region in the following centuries.

In the Cibola region the Pueblo II period is associated with the widest geographic distribution of settlements, although notably the El Morro Valley appears to have been lightly occupied before A.D. 1250 (Huntley and Kintigh 2004; Kintigh 2007; Schachner

2012; Peeples et al. 2012; Watson et al. 1980). Pueblo II period habitations were established as isolated or loosely clustered masonry roomblocks along major drainages and well-watered areas across the Cibola region. These roomblocks, occasionally associated with pit structures or kivas, average ten rooms and likely housed one or a few families (Kintigh 2007). While most recorded Pueblo II settlements appear to have been occupied year-round, there may have been a higher degree of residential mobility in some portions of the study area. Within at least the Central Zuni and Silver Creek areas to the south, archaeobotanical evidence suggests that a degree of seasonal site usage persisted into the Pueblo II period (e.g. Mcbride 2004; Ruppe 1987).

Several slightly larger settlements (i.e., 20-30 rooms) were occupied in the late Pueblo II period (ca. A.D. 1000-1150). In the northern Cibola region some of these settlements incorporate Chacoan-style architectural features including great houses, circular great kivas, road segments, and berms (Duff and Lekson 2006; Duff and Schachner 2007; Fowler et al. 1987; Mahoney et al. 1995; Roberts 1932, 1939). In southern portions of the Cibola region, larger Pueblo II period settlements are associated with rectangular great kivas (Danson 1957; Herr 2001). These differences in public architectural forms between the northern and southern areas of the Cibola region are thought to represent different cultural and historic ties to the north (i.e., Chaco) and south (i.e., Mogollon Rim and Arizona Mountains) respectively (see Peeples et al. 2017). The nature and distribution of these public architectural forms has also been linked to the development or emergence of increasingly distinctive sociopolitical boundaries and traditions within the region over time (e.g., Duff and Lekson 2006; Dungan and Peeples 2018; Herr 2001; Peeples 2018; Peeples et al. 2017). Despite architectural differences there is evidence for a high degree of population circulation and interaction across the greater Cibola landscape in the Pueblo II period, as evidenced by broadly shared traditions of ceramic vessel production and exchange, namely Cibola White Ware vessels (e.g., Mills 2007b; Peeples 2018). As will be discussed in Chapter 6, similar patterns can also be observed in Pueblo II period groundstone technological traditions.

Pueblo III: A.D. 1150-1275

Across the Cibola region and much of the U.S. Southwest the Pueblo III, or post-Chacoan period, has long been associated with population aggregation, settlement growth, social reorganization, and in some areas heightened levels of violence and warfare (e.g., Adler 1996a; Kintigh 1994, 1996; Kintigh et al. 2004; Kohler et al. 2014; LeBlanc 1999, 2001; Watson et al. 1980). Paleoenvironmental data indicate this period was bracketed by extended intervals of relatively “chaotic” warm-dry climatic conditions and extremely low precipitation ca. A.D. 1131-1192 and 1250-1297 respectively (Dean 2007:89; Van West and Grissino-Mayer 2005:33.18). A greater investment in runoff agriculture in these warm-dry intervals is supported by rapid shift to settlement construction in upland locations as opposed areas more suited for floodplain agriculture in this period (Kintigh 1985). As might be expected with an increased investment in runoff agricultural strategies, the Pueblo III period is also associated with the construction of numerous water and soil control features in the Cibola region and more broadly across the northern U.S. Southwest (Black n.d.; Huckell and Toll 2004:62; Stone 1991; see also Chapter 5).

While limited excavation data obscure exactly when settlement aggregation in the Cibola region were first began, larger settlements or villages of aggregated roomblocks were established by the early 13th century (e.g., Huntley and Kintigh 2004; Kintigh 1996, 2007; Kintigh et al. 1996; Kintigh et al. 2004; Schachner 2012; Zier 1976, 1983). Settlement layouts and architectural forms display enormous diversity throughout this period (e.g., Kintigh 1985, 1996; Peeples 2018; Schachner 2012; Watson et al. 1980). Averaging 20 rooms, roomblocks across the northern Cibola region could have housed multiple families (Kintigh 1996, 2007). A number of larger (i.e., 50-100 room) roomblocks were constructed in the El Morro Valley in the early 13th century, suggesting the coordinated movement of multiple household groups into this area in the early 13th century (Schachner 2012:137-139). In portions of the Central Zuni and El Morro Valley, there are also several large clusters of 10 to 30 contemporaneous roomblocks that form very large concentrated villages of more than 500 rooms (Fowler et al. 1987; Kintigh 1996, 2007; Kintigh et al. 1996; Kintigh et al. 2004; Saitta 1994; Watson et al. 1980).

Some large aggregated villages appear to be associated with structures with Chacoan-like architectural features (e.g., Duff and Lekson 2006; Fowler et al. 1987; Kintigh 1994, 1996; Kintigh et al. 1996; Schachner 2012). These 13th century structures are often referred to as post-Chacoan great houses as they appear to be explicitly referencing, and perhaps reinterpreting, earlier Chacoan architectural forms to suit local social and political needs (Cameron and Duff 2008; Duff and Lekson 2006; Duff and Schachner 2007; Fowler et al. 1987; Kintigh 1994, 1996; Kintigh et al. 1996). Circular great kivas appear to have been frequently replaced by larger unroofed great kivas in this period. Unroofed great kivas could have hosted far larger groups of participants and spectators and perhaps represent a greater investment in integrating populations and expressing or reinforcing shared collective or categorical (see Peeples 2018) social identities (e.g., Dungan and Peeples 2018; Kintigh 1994, 1996; Kintigh et al. 1996; Kintigh et al. 2004; Schachner 2012).

While population aggregation in the Central Zuni area appears to have been a multi-generational process (Kintigh et al. 2004), the construction of aggregated villages and later nucleated towns in the El Morro Valley was extremely rapid and unprecedented (Schachner 2012:79-88; Watson et al. 1980). The initial establishment of settlements in the El Morro Valley ca. A.D. 1225 was followed by an explosion of construction activity in the mid-13th century (Huntley and Kintigh 2004; Kintigh 1985, 2007; Schachner 2012; Watson et al. 1980). This area quickly emerged as a major population center of the northern Cibola region in the late 13th century (Kintigh 1985, 2007; Schachner 2012). El Morro Valley settlements display a particularly high degree of heterogeneity in public architectural forms in the Pueblo III period, including roofed and unroofed great kivas and notably early examples of plazas (Schachner 2012:143-147). The variety and scale of residential and public architectural forms consistently documented in the El Morro Valley suggest that a degree of experimentation with novel social forms and activities (including ritual commensal events) played an important role in facilitating population interactions, settlement aggregation, and social integration in this period. I address these topics further in Chapters 7, 8, and 9.

Extensive studies of decorated ceramic vessel production and circulation as well as tree-ring dates document high rates of interaction and population circulation within and between the El Morro and Central Zuni areas in the Pueblo III period (e.g., Duff 2002; Huntley 2008; Peeples 2018; Schachner et al. 2011; Schachner 2012). Populations in these areas appear to have become increasingly closed-off and disconnected from networks of social interaction and exchange both with other Cibola settlement areas and more broadly with other regions of the U.S. Southwest in the 13th and 14th centuries (Borck et al. 2015; Mills et al. 2013; Mills et al. 2015; Peeples 2018; Peeples and Haas 2013; Schachner et al. 2011). This pattern is reversed in the Upper Little Colorado area, where social networks were highly embedded and increasingly characterized by strong social ties to diverse external groups in the Pueblo III and especially Pueblo IV periods (Borck et al. 2015; Duff 2002; Mills et al. 2013; Mills et al. 2015; Peeples 2018; Peeples and Haas 2013).

Upper Little Colorado settlement patterns in the 13th century are less well understood than those in the Central Zuni and El Morro Valley areas. A degree of settlement aggregation is observable, although changes in settlement size are less pronounced (Kintigh 1996:136-137). Settlements generally consist of one or several loosely clustered roomblocks that range between 15 and 100 rooms (e.g., Danson 1957; Longacre 1964). Across the southern Cibola settlement areas, there generally appears to have been more continuity in both the location and size of Pueblo II and III period settlements (e.g., Danson 1957; Herr 2001; Martin et al. 1956, 1957). The process of aggregation and settlement construction also appears to have been slower in southern Cibola areas. Architectural evidence suggests that settlement growth in the Upper Little Colorado areas was an accretional process that ultimately produced more irregular settlement layouts (e.g. Clark et al. 2006; DeGarmo 1975; Martin et al. 1962). Rectangular great kivas, with a few architectural modifications, appear for the first time in the Upper Little Colorado area in the Pueblo III period (e.g., Clark et al. 2006; Danson and Malde 1950; DeGarmo 1975; Dungan and Peeples 2018; Martin et al. 1962).

Pueblo IV: A.D. 1275-1400

The late 13th and early 14th centuries are associated with a range of dramatic social transformations across the northern U.S. Southwest which to varying degrees involved: (1) the concentration of populations into large, dense plaza-oriented pueblos (e.g., Adams and Duff 2004a; Duff 2002; Huntley and Kintigh 2004; Kintigh 2007; Spielmann 1998a); (2) the development or adoption of new integrative ideological and religious forms (e.g., Adams 1991; Crown 1994; Glowacki and Van Keuren 2011; but see Dungan and Peeples 2018); and (3) regional depopulations and large-scale, long-distance migrations (e.g., Adams and Duff 2004a; Cordell 1995; Cordell et al. 2007). Across the Cibola region, the late 13th century saw the widespread abandonment of earlier roomblock villages and a wholesale transition to large, frequently planned towns with room counts ranging from one hundred to over one thousand (Duff 2002, 2004; Huntley and Kintigh 2004; Kintigh 1985, 1996, 2007; Kintigh et al. 2004). This process of population concentration and settlement reorganization over the late 13th and early 14th centuries resulted in the creation of increasingly large uninhabited zones between the remaining settlement clusters in the Cibola region (Duff 2002, 2004; Huntley and Kintigh 2004; Kaldahl et al. 2004; Kintigh 1996; Kintigh et al. 2004). By the mid-14th century, populations outside of the Central Zuni area were living in only handful of large pueblos in the El Morro, Upper Little Colorado, Arizona Mountain, and Silver Creek areas (Peeples 2018). By A.D. 1400 most of the Cibola region was depopulated save for nine massive pueblos concentrated along the Zuni River (Kintigh 1985).

While climatic conditions in the late 13th and late 14th centuries were relatively warm and dry, bristlecone pine chronologies suggest that the mid-1300s were an interval of relatively cool, wet conditions in the Cibola region (Dean 2007:83-84). Northern Cibola settlements established in the early Pueblo IV period (ca. A.D. 1275-1325) generally favor upland locations, likely reflecting a continued focus on dryland farming strategies. Settlements established in the late Pueblo IV period (ca. A.D. 1325-1400) favor lower-elevation locations, in contrast, suggesting a transition towards spring and river irrigation strategies (Kintigh 1985). The establishment of nucleated pueblos adjacent to the Upper Little Colorado River is thought to indicate a widespread investment in floodplain agriculture and river irrigation strategies in the Upper Little Colorado area throughout the Pueblo IV period (Duff 2004:75).

In the Central Zuni and El Morro Valley, the late 13th century saw the construction of roughly 40 large (i.e., over 200 room) plaza-oriented pueblos (Huntley and Kintigh 2004; Kintigh 2007). The earliest of these were established in the El Morro Valley (Schachner 2012). Tree-ring and relative ceramic dates indicate that most of these towns were established sometime between A.D. 1250 and 1300, meaning that there was a degree of contemporaneous occupation of both aggregated villages and nucleated pueblo settlements (Duff and Schachner 2007; Schachner 2012). The high degree of residential mobility and evidence for the construction of rooms that were never occupied, hint at an especially dynamic and/or unstable social landscape in the El Morro Valley in the early Pueblo IV period (CARP notes; Schachner 2012; Watson et al. 1980). By A.D. 1300, virtually the entire population in the northern Cibola area was living in one of several large towns within some 5 to 10 km of each other (Huntley and Kintigh 2004; Kintigh 1985, 2007; Schachner 2012). In contrast with more southern Cibola areas, the process of aggregation in the Central Zuni and El Morro Valley areas appears to have involved the consolidation of local populations as opposed to the incorporation and mixing of more distant migrant groups with local groups (Kintigh et al. 2004; Peeples 2018).

Differences in the architectural plan of nucleated pueblos suggest there was a degree of complementarity and/or competition between Pueblo IV period settlements or settlement clusters. In the Central Zuni and El Morro Valley, towns appear to have been constructed primarily as either rectangular or oval shaped settlements, though other composite or irregular forms have been recorded (Huntley and Kintigh 2004; Kintigh 1985, 2007; Watson et al. 1980). As these forms are contemporaneous it has been argued that architectural differences intentionally expressed or reflected cosmological and/or ritual distinctions between towns of these shapes (i.e., Potter 1997). Parallel arguments (but see Kintigh 2007:373-374) have also been made based on the distribution of different distinctive ceramic vessel types (i.e., Kwakina Polychrome) associated with rectangular versus oval settlements in the early Pueblo IV period (Huntley and Kintigh 2004). Differential use of specific ritual fauna (i.e., raptors and perching birds versus water-fowl) have also been associated with the different settlement forms (Potter 1997a:224-226; Potter and Perry 2000:72-74).

In the north, many Pueblo IV period towns show evidence of rapid, planned construction that suggests a high degree of cooperation and coordination (Peeples 2018; Schachner 2012; Watson et al. 1980). Nucleated pueblos were constructed typically as single large roomblocks surrounding a central plaza (Kintigh 1985; Spier 1917). Distinct size modes have been noted for these settlements at 200 and 900 rooms respectively, although the very largest have over 1000 rooms (Huntley and Kintigh 2004; Kintigh 1985, 2007). These unusually large settlements may represent early attempts at integrating large aggregated villages into novel settlement forms (Kintigh et al. 2004). Population circulation was high in this period, especially in the El Morro Valley (Schachner 2012). Few nucleated pueblos established in the early Pueblo IV period were occupied for longer than one or two generations (if that) (Huntley and Kintigh 2004; Kintigh 1985; Schachner 2012). Overall, Pueblo IV period settlement patterns suggest that a degree of social experimentation and instability were regular features of life in larger settlements and that the social cooperation needed to plan and rapidly construct large pueblos was not always enough to maintain a coherent social community thereafter (Kintigh 1985:115-117; Schachner 2012).

The Pueblo IV period in the Upper Little Colorado is associated with the establishment of nine nucleated pueblos in several clusters along the Upper Little Colorado River (Duff 2002, 2004). Compared to the pueblos constructed in the Central Zuni and El Morro areas, Pueblo IV period settlements in the Upper Little Colorado increased relatively little in size in this period. While slightly larger settlements rarely exceeded 100 rooms in this area (Duff 2004). Architectural forms exhibit a fairly high degree of local variation in layout and in the inclusion (or absence) of public architectural spaces (i.e., great kivas, plazas, courtyards) (Duff 2002, 2004). Overall, settlement growth along the Little Colorado River and in other southern Cibola areas appears to have remained slow and accretional in this period (Peeples 2011:77-78).

In contrast with northern Cibola settlement areas, ceramic vessels consistently display a high degree of diversity both at inter-site and intra-site levels in the Upper Little Colorado area (Duff 2002, 2004; Hegmon et al 2016; Peeples 2018). Duff (2004:79; see also Peeples 2018) notes the presence of a north-south divide in the circulation of ceramic plainwares and various decorated wares between settlement clusters along the Upper Little Colorado River. This suggests the maintenance of a diverse range of social ties and long-distance exchange networks by families and communities within the Upper Little Colorado in this period (e.g., Borck et al. 2015; Duff 2002, 2004; Hegmon et al. 2016; Mills et al. 2013; Peeples 2018; Peeples and Hass 2013). Architectural and ceramic data from Upper Little Colorado settlements (e.g., Table Rock Pueblo) suggest that the establishment of Pueblo IV period nucleated pueblos often involved a degree of mixing between locals and more distant migrant groups with diverse ceramic and/or ideological traditions (e.g., Salado Polychrome, Jeddito Yellow Ware) (Duff 2002, 2004; Martin and Rinaldo 1960). Some of the non-local populations joining these settlements were likely migrants from the western Hopi Mesas or southern Silver Creek and Mogollon Rim areas. As such, ceramic data documenting the maintenance of broader social ties is perhaps not surprising, although it raises interesting questions concerning processes of maintenance, mixing, and even innovation in cuisines in this area (Chapter 9).

Summary

The 13th and 14th centuries across the Cibola region were a period of dramatic social transformation that began with a shift from small, singular roomblock habitations to aggregated roomblock villages and that culminated in the concentration of populations into a handful of large pueblos in the late 14th century. While individuals in each of the settlements and settlement areas compared in this study lived during this process of aggregation and settlement nucleation, their experiences would have differed somewhat across each case (Table 3.2). In the El Morro Valley and Central Zuni areas, families saw dramatic, unprecedented, and perhaps unsettling changes in their social and built environments over the course of one or two generations. This process was particularly rapid and dynamic in the El Morro Valley where large groups joined in novel ways in previously unoccupied areas. In the Upper Little Colorado, settlements grew at a relatively slower rate, but the process involved the mixing of socially and ideologically diverse groups and sometimes the incorporation of distant migrant families.

Research Objectives and Organization of Research

In the final section of this chapter, I outline the major research objectives, questions, and expectations that guide the analyses of cuisine and commensality in the following chapters. A comparative examination of daily foodways across the Cibola region allows for a far richer understanding of the relationships between cuisine, commensality, and the different trajectories of population aggregation and social transformation that characterize each settlement area in this study. Table 3.2 provides a reference for comparing major differences in the aggregation process across each study area. "Social Heterogeneity" reflects the degree of social or "representational diversity" (*sensu* Hegmon et al. 2016) in each settlement area. "Settlement Growth" refers to the level of demographic and/or settlement-size increase associated with aggregation and settlement nucleation in each area. Finally, "Pace of Change" reflects differences in the speed of process.

Table 3.2. Aggregation and Social Transformations across Cibola Region.

Settlement Area	**Social Heterogeneity**	**Demographic Growth**	**Pace of Change**
Central Zuni	Low	Moderate	Moderate
El Morro Valley	Moderate	High	Rapid
Upper Little Colorado	High	Low	Slow

Examining changes in cuisine and commensality requires first establishing baselines of daily food activities that can then be compared at multiple temporal and spatial scales. As outlined in Chapter 2, approaches that explore how daily food practices persist or change over time in different social and spatial contexts, provide important insights into how individuals and communities were (dis)connected to processes of social and political change through food. Baselines of daily food activities are also essential for identifying and comparing daily meals with special commensal events (e.g., VanDerwarker et al. 2007). I address patterns of daily food practice in the beginning sections of each of the following analytical chapters that focus on different sets or stages of food activities: food production (Chapter 5), storage and preparation (Chapter 6), cooking (Chapter 7), and serving and consumption (Chapter 8) (Table 3.3). Chapter 4 provides more detailed discussions concerning the datasets, sampling strategies, and analyses used to evaluate the different sources of archaeological data in this study.

Given the close associations between cuisine, identity, memory, and place (Chapter 2), comparing trajectories of cuisine across of the Cibola region allows me to address different mechanisms or social arenas that may have encouraged persistence and/or innovation in cuisine. With population aggregation and settlement reorganization, related changes in networks of social interaction, exchange, and learning (e.g., Peeples 2018) might often be expected to influence the diversity of cuisine practices and the adoption and spread of novel foods. Given the important role and value of foods in the ritual practice and communal life of small-scale societies, the formation of social communities (i.e., coalescence) and increasing participation in communal ideologies and religious beliefs are also expected to influence both the kind and amounts of foods being produced and prepared over time.

I expect that levels of heterogeneity and homogeneity previously documented in architectural and ceramic vessel technologies will be paralleled in cuisine, and that the greatest diversity and degree of change in cuisine practices will be in settlements in the Upper Little Colorado. Changes in mobility and settlement location, especially for groups migrating over large distances, often involve a degree of rupture in cuisine. While domesticated and encouraged cultivated plants and animals (i.e., turkeys) would generally be expected to accompany migrating groups, previously seasonally gathered foods if no longer locally accessible were likely often be replaced in daily meals with nearby substitutes. Some use of previously gathered foods however, may have persisted as prized specially collected or traded for treats (e.g., Cushing 1920:229, 235, 635-636).

Table 3.3. Organization of Research Objectives, Data, and Analyses.

Research Objective	**Data**	**Analyses (see Chapter 4)**	**Chapter(s)**
Establish baselines of daily food practice	Macrobotanical, pollen, and zooarchaeological data	Analysis of patterns of staple produced and gathered plant and animal foods	5,7
	Groundstone, ceramic, and architectural feature data	Analysis of patterns of foodcraft manufacture and use	6-8
Compare trajectories of continuity and change in cuisine	Macrobotanical, pollen, and zooarchaeological data	Analysis of staple foods and local ingredient and flavor use	5,7
	Groundstone, ceramic, and architectural feature data	Analysis of food preparation and cooking technologies and techniques	6-8
Examine changes in the organization and intensity of food production, preparation, and commensality	Macrobotanical and zooarchaeological data	Analysis of food production organization and intensity	5
	Groundstone, ceramic, and architectural feature data	Analysis of food storage, preparation, and cooking organization and intensity	6,7
	Zooarchaeological, ceramic, and architectural data	Analysis of food consumption and discard organization and intensity	8

In Chapter 5, I employ macrobotanical ubiquity and faunal indices (i.e., artiodactyl, turkey index) to evaluate patterns in the production of staple grown and gathered plant and animal foods in the Cibola region from the Pueblo II period onwards. In Chapters 5 and 7, I also use large databases of macrobotanical and pollen data to address more local-scale variations in the use of signature gathered foods and flavoring agents. I address spatial and temporal changes in the use of food preparation and cooking technologies and techniques through the analyses of the manufacture and use of groundstone mealing equipment (Chapter 6), architectural cooking and mealing features (Chapter 7), and ceramic storage, cooking, and serving vessels (Chapters 7 and 8).

Understanding the roles of food in periods of aggregation and social transformation requires examining contexts of food sharing and exchange and asking how such activities may have shifted in scale, frequency, or inclusivity over time. Previous studies of feasting in the 13th and 14th centuries in the northern U.S. Southwest suggest that communal ritual feasts in public architectural spaces were critical for establishing and maintaining social and political relationships at larger social scales (e.g., Adams 1991; Dean 2001; Potter 1997a; Potter and Ortman 2000; Varien et al. 2017). In the Cibola region I expect that feasting often played an important role in attracting and integrating social groups in the late 13th century.

I consider the degree to which transformations in the scale of social life also involved changes in the organization and intensity of food production, preparation and of commensal activities in each of the analytical chapters (Table 3.3). Increases in the scale or frequency of large commensal events would also likely involve a substantial increase in the work of producing, preparing, and cooking foods for these events compared to daily meals. In Chapter 5, I draw on macrobotanical data to examine trajectories of agricultural intensification following aggregation and settlement nucleation. Chapters 5 and 8 employ extensive databases of faunal data and indices of turkey and large-bodied game to address changes in animal food production and consumption rates between each case area. I examine changes in the organization and intensity of food preparation by using groundstone data in Chapter 6, while changes in the organization and scale of cooking activities draws on ceramic cooking vessel and architectural cooking feature data in Chapter 7. Chapter 8 draws on ceramic serving vessel, faunal, and architectural data to examine changes in commensality.

Finally, in Chapter 9, I review how different trajectories in cuisine and commensal practice played out against broader regional and more local processes of settlement aggregation and social coalescence discussed in this chapter. Building on the results of Chapters 5 through 8, I consider how continuity or change in food practices might have impacted the lives, labor, and identities of the individuals involved producing, preparing, and consuming these foods and meals across the Cibola region. This chapter provides a synthesized discussion the of the contributions from this study, both in terms of understanding the role of food in the social transformations that reshaped the social landscape of the Cibola and northern U.S. Southwest in the late 13th and 14th centuries, and broadly for understanding how people relate to and through food in periods of social change.

Chapter 4:

ARCHAEOLOGICAL APPROACHES TO FOODWAYS

"Different data sets may represent different stages of food's interaction with humans…the more closely we can integrate different specialties through the analytic and interpretive process, the stronger our interpretations of the past should be (Twiss 2015:90-92)."

This chapter provides the methodological and analytical foundations, or raw ingredients, for the studies of cuisine and commensality in the following chapters. Given the limitations of archaeological data for directly examining certain aspects of foods and meals in the past, assessments of cuisine and commensality are strengthened by synthetic approaches that draw on multiple material proxies at a range of temporal and spatial scales (Hastorf 2016; Twiss 2015). Furthermore, archaeological studies of food benefit from considering the interrelationships between the material remains of foods and food crafts and the different individuals, bodily motions, and places that surround food at every step from its production to its deposition in the archaeological record (e.g., Atalay and Hastorf 2006). In this study three primary types or categories of archaeological data were collected and synthesized: (1) the remains of plant and animal foods; (2) groundstone mealing and ceramic container food technologies; and (3) the spaces and features used to produce, prepare, consume, and discard foods. Each of these data categories, sampling procedures, measured variables, and analyses are discussed below.

Archaeological Remains of Food

Archaeological remains of plants and animals provide direct insights into the foods consumed in the past, making them essential for examining histories of cuisine and addressing questions about changes in the nature and scale of food production and consumption practices. In the following sections I describe the datasets and analytical methods I employ to examine and compare trajectories of plant and animal food use across the Cibola area. Appendix A.1 provides a list of the Zuni and English common names for the various plant and animal foods that available archaeological evidence suggest were food resources in prehispanic periods.

Plant Food Data

Plant remains recovered from archaeological excavations are important sources of information about past human-environmental interactions. Analysis of plant materials provides a way to examine and compare daily plant food production and preparation practices in relation to broader changes in sociopolitical and environmental conditions. Botanical remains recovered by hand or chemical extraction from archaeological contexts provide a mixture of direct and indirect evidence of patterns of past plant use as well as the vegetation communities that existed around archaeological sites during their occupations (Pearsall 2015). Ethnoarchaeological studies suggest that archaeological plant materials usually represent the remnants of the routine, everyday activities that transform plants from stored to consumable forms (e.g., Hillman 1981, Jones 1987, Stevens 2003).

To understand patterns in the daily use of plant foods across the Cibola region, macrobotanical remains recovered by hand and through systematic sampling and flotation, as well as available pollen data are considered in this study. Together these sources of botanical data provide a complementary and more complete picture of the different plants were prepared and consumed in the Cibola region through time. In particular, pollen analyses are vital for detecting and understanding the use of plants whose greens, flowers, and other non-woody parts would not normally encounter or survive charring processes. Other microbotanical plant data (i.e., starches, phytoliths, residues) also provide crucial insights into the uses of different foods and processing techniques that are otherwise invisible in the macrobotanical record. However, as these plant materials have not characteristically been collected as part of academic or professional cultural resource management (CRM) projects in the Cibola region they are not considered in this study.

Ubiquity and density measures of macrobotanical remains, particularly domesticated cultivars and disturbance-loving plants, can be used to address changes in the nature and intensity of agricultural production and to compare the relative importance of different grown and gathered plant foods at regional scales through time (e.g., Hard et al. 1996; Gasser and Kwiatkowski 1991; Oas et al. 2015; Sinensky and Farahani 2018). In this dissertation, presence-absence and ubiquity values of systematically sampled macrobotanical remains provide the primary sources of quantitative data. The underlying assumption with ubiquity analyses is that the frequency at which one encounters certain plant taxon from independent samples in an archaeological site provides a relative measure of the economic importance of the plant (Popper 1988; Pearsall 2015).

The absence of plant taxa is more difficult to interpret. Low recovery rates may indicate biases in sampling or more often, may reflect differential preservation rates of certain plant taxa or plant parts when exposed to fire (e.g., woody stems versus flowers). Differences in recovery rates may also reflect different processing and cooking practices (e.g., parching versus boiling). This recovery bias has long been recognized in relation to interpreting the recovery rates of bean and squash remains in the U.S. Southwest (Gasser and Adams 1981:183-184).

It is important to note here that the maize ubiquities presented in this study reflect the inclusion of both kernel and cupule remains, as several of the reports used in this study were inconsistent in reporting the parts of maize that were recovered in each sample. The decision to include both kernel and cupule remains likely inflates the ubiquity of maize to a degree as cobs were commonly used as fuel sources. On the other hand, the use of kernels alone likely dramatically underestimates the amount of maize used (Bohrer 1976; Minnis 1985).

Chuck Wills (2001) has cautioned against the careless use of maize ubiquity to address changes the intensity of maize agriculture in the U.S. Southwest, given potential differences between site function, size, and occupation duration. These concerns are minimized for this study as arguments for agricultural intensification utilize several lines of archaeological data and because the macrobotanical data were recovered from settlements that were occupied year-round (Chapter 3). Finally, the ubiquity measures presented in this study only draw on flotation data from studies that sampled a wide range of well-dated domestic and extramural features and contexts (Appendix B.1).

Cibola Plant Database

To characterize the types of plant foods being eaten and to examine regional and temporal patterns in plant food production and use, macrobotanical and pollen data were gathered from published and unpublished academic and CRM reports from 54 sites (Appendix B.1). These reports include studies from settlements in the three core settlement areas of this study, as well as complementary data from two additional settlement areas to the west and southwest: the Puerco West and Silver Creek/Arizona Mountain areas. Plant assemblages from the 46 sites that had a minimum of at least ten productive flotation samples were included in further quantitative assessments, as this was considered the minimum needed to avoid the worst skewing that can occur for presence-absence analyses because of small samples sizes (e.g. Miller 1988; Pearsall 2015). Only plant remains that could conservatively be considered as food resources were included in this analysis, meaning that generally only the presence of charred plant foods and food by-products (e.g. seeds, fruits, nutshells) were incorporated. For pollen, only pollen from non-wind-pollinated species or pollen aggregates interpreted by the analyst as culturally significant were incorporated into the database (e.g. Gish 1991).

In addition to using previously reported plant data, 30 flotation samples were also analyzed from sites in the Upper Little Colorado (Oas 2017b,c). As almost no previous paleoethnobotanical work has been done for Pueblo III and IV period settlements in this area, these data were necessary to assess changes in the ubiquity and the diversity of different grown and gathered wild food resources in the Upper Little Colorado. Sorting and identification of plant remains from the light fraction followed standard paleoethnobotanical procedures (Pearsall 2015). This included the initial sorting of charred plant materials using graded geological sieves into different size classes (e.g., >2mm, >1mm) to enhance the ease and reliability of sorting. Identification of botanical species was done using comparative collections and published manuals (e.g., Adams and Murray 2004; Martin and Barkley 1961). All samples were examined using a dissecting binocular light microscope (10 to 40X). Only charred plant specimens were considered to be prehistoric (Minnis 1981). For each sample, up to 20 wood charcoal specimens

(>2mm) were sub-sampled, broken, and identified using fresh transverse and radial sections.

Table 4.1. Cibola Plant Food Taxa: A.D. 900-1400.

	Scientific Name	Common Name
Cultigen	*Cucurbita* sp.	Squash
	Cucurbita argyrosperma[1]	Cushaw Squash
	Cucurbita pepo	Pumpkin
	Gossypium hirsutum[3]	Cotton
	Phaseolus sp.	Bean
	Phaseolus acutifolius	Tepary bean
	Phaseolus lunatus	Lima Bean
	Phaseolus vulgaris	Common Bean
	Zea mays	Maize

	Scientific Name	Common Name		Scientific Name	Common Name
Agrestal	*Amaranthus* sp.	Pigweed	**Wild Economic**	*Achnatherum hymenoides*	Ricegrass
	Astragalus sp.	Milkvetch		*Arctostaphylos* sp.	Manzanita
	Chenopodium sp.	Goosefoot		*Artemesia* sp.	Sagebrush
	Chenopodium/Amaranthus type[2]	Cheno-am		*Atriplex* sp.	Saltbrush
	Cleome sp.	Beeweed		*Berberis* sp.	Barberry
	Corispermum sp.	Bugseed		*Celtis* sp.	Hackberry
	Cycloloma atriplicifolium	Winged Pigweed		*Echinocerus* sp.	Hedgehog cactus
	Descurainia sp.	Tansy Mustard		*Juglans major*	Walnut
	Eriogonum sp.	Buckwheat		*Juniperus* sp.	Juniper
	Helianthus sp.	Sunflower		*Mentzelia* sp.	Stickleaf
	Lepidium sp.	Peppergrass		*(Cylindr)opuntia* sp.[2]	Cholla/Prickly Pear
	Lupinus sp.	Lupine		*Opuntia* sp.	Prickly Pear Cactus
	Oenothera sp.	Evening Primrose		*Quercus* spp.	Oak
	Physalis sp.	Tomatillo		*Pinus* spp.	Pinyon
	Plantago sp.	Plantain		*Polygonum* sp.	Knotweed
	Portulaca sp.	Purslane		*Rhus trilobata*	Sumac
	Salvia sp.	Chia		*Rosa* sp	Rose
	Vicia americana	American Vetch		*Scirpus* sp.	Bulrush
	Xanthium sp.	Cockleburr		*Sphaeralcea* sp.	Globemallow
				Sporobolus sp.	Dropseed
				Typha sp.[3]	Cattail
				Vitis sp.	Wild Grape
				Yucca sp.	Yucca
				Yucca baccata	Banana Yucca

[1]formerly *C. mixta*

[2]Morphologically indistinct

[3]Recovered almost exclusively as pollen

Table 4.1 provides a full list of the plant food taxa recovered from sites across the Cibola region that were occupied between A.D. 900-1400. Plant food remains are divided into three categories based on previous macrobotanical and ethnobotanical studies, as well as major differences in plant life history strategies or traits (i.e., annuality, perenniality). The cultivar category consists entirely of known domesticated food taxa (e.g., maize, beans). The agrestal plant category includes pioneering plant species that quickly colonize disturbed landscapes and are typically annual species. The wild economic category includes primarily perennial plants that take longer to grow and mature and do not colonize disturbed ground as quickly as annuals. Several species of plant foods in the agrestal and wild economic categories (e.g., amaranth, cholla) were likely prehispanic domesticated crops or encouraged cultivars across the Greater Southwest (see Chapter 5).

For both the agrestal and the wild economic categories, these only include taxa known to have been food sources based on previous studies of coprolites, macrobotanical and pollen data, and the ethnographic record (e.g., Huckell and Toll 2004; Minnis 1989; Moerman 2003). Plant remains that were only identifiable to family level, taxa not previously identified as food species in the literature, and unidentifiable charred plant materials, including spines, thorns, tissues, and seeds too damaged to be furthered identified are not considered in this study. Information about "non-food" plant remains and unidentifiable plant materials for all sites included in this plant database can be found on the Digital Archaeological Record (tDAR) (Oas 2016a, 2016b, 2016c, 2017a, 2017b, 2017c).

Maize Cob Row-Number

Maize morphology is tied to a complex array of genetic, environmental, and cultural influences (Adams 2015; Adams et al. 1999; Swartz et al. 2017). Whole, uncharred cobs and kernels remain the best sources of information concerning the varieties of maize grown in the past. These collections are uniquely suited to provide information about past maize landraces in terms of kernel endosperm types (e.g., flint, flour, pop) and especially traits like color (e.g., red, blue, speckled, white) that contemporary Puebloan farmers use to categorize traditional maize varieties (Bohrer 1960; Ermigiotti et al. 2018; Cushing 1920; Ford 1980; Stevenson 1915; Whiting 1939). Unfortunately, outside of caves or other dry, sheltered contexts most maize remains recovered archaeologically are preserved as a result of exposure to fire. The charring process obscures color and distorts a range of morphological traits on cobs and kernels (Benz 1994). This presents a serious challenge for analysts looking to discern trends in the production and use of different maize varieties in the past (see Adams 2015)

Despite these difficulties, there is a long history of analyzing a range of charred cob and kernel morphological traits to assess the variability in the maize landraces in the past (e.g., Adams 1994; Benz 1994; Benz and Iltis 1990; Bird 1994; Cutler and Meyer 1965; King 1994; Huckell 2006; Morehart and Eisenberg 2010; Turkon 2006). Adams and colleagues (1999:489) have suggested that cob row-numbers provide a more reliable indicator of past maize landraces given that row number is established very early in development. In other words, cob row-number is less influenced by environmental conditions than other morphological traits like kernel width.

The value of cob row-number as opposed to other morphological data is further supported by experiments conducted by Natalia Martínez and Karen Adams (2008) that sampled a variety of maize landraces grown as part of a systematic grow-out experiment (Adams et al. 2006) and tested the effects of charring on a range of morphological traits commonly used to identifying major maize landraces. The results of their study support that cob length and row number (or cupule angle in the case of fragmented cobs) provide some of the most reliable data for examining differences in the varieties of maize present in charred macrobotanical assemblages (Adams 2015:35).

To assess variation in the types of maize grown across the Cibola region in the 13th and 14th centuries, maize cob row-numbers were collected from 22 sites across the Central Zuni, El Morro Valley, and Upper Little Colorado. A few reports of maize-row data from complementary portions of the Cibola region (i.e., Hay Hollow Valley, Silver Creek) were also included. The maize row-number data used in this study combines previously published and unpublished analyses of maize cobs with additional data collected by the author targeting sites mainly in the Upper Little Colorado area (Appendix B.2).

Animal Food Data

To understand changes in animal food use over time, this study compiled available faunal data from a mixture of published and unpublished reports from 36 sites. (Appendix C.1). Faunal databases provide a critical source of information concerning the nature and extent of animal food production and procurement, differences in meat preparation and cooking techniques (e.g., butchering, roasting), and the contexts associated with processing, cooking, and consuming different animal foods within settlements (e.g., Dean 2001; Clark 1998a; Potter 1997a, 1997b, 2000). Measures of faunal data, particularly standardized indices like the artiodactyl index, have also long been used to examine changes in hunting strategies and the relative availability of animal food resources over time in the U.S. Southwest (e.g., Badenhorst and Driver 2009; Potter 1997a; Schollmeyer and Driver 2013).

Only counts of number of identified specimens (NISP) were used in this study. While NISP measures may somewhat inflate the presence of taxon, other quantification methods (e.g., minimum number of individuals [MNI]) are also problematic (see Lyman 2008; Reitz and Wing 1999). Issues may also arise when animal internments are present, as these can also inflate specimen counts. For this study, this was a potential issue for only nine sites with articulated turkey interments (Appendix C.1). When articulated turkey internments were reported in enough detail and could be separated from the rest of the assemblage, NISP were adjusted.

To synthesize and compare faunal assemblages assessed by different analysts, some decisions had to be made to standardize the data. In this study, specimens given the prefix “cf.” or “possibly” were considered to be the listed taxon. In other cases numerous species were lumped into broader taxonomic categories (usually genera) where it was unlikely that accurate identifications to the species level could have been made based on morphology alone (see Yang et al. 2005). Synthetic overviews of faunal remains are also subject to issues that arise from taphonomic differences between sites, different sampling methods, the identification proficiency of analysts, and the quantification methods used to tabulate remains. Despite these concerns, the majority of the Cibola faunal data used in this study were recovered with similar sampling and recovery methods and identified by a consistent set of analysts using similar identification, recording, and quantification methods. These data have previously been synthesized and made available on tDAR (see Appendix C.1).

Faunal Indices

Measures of faunal data, particularly standardized artiodactyl, lagomorph, and turkey indices, have traditionally been used in the U.S. Southwest to evaluate changes in large-game hunting strategies, resource depression, and to a lesser extent the provisioning of meat for communal feasts (e.g., Dean 2001; Badenhorst and Driver 2009; Driver 2002; Potter 1997a, 2007b, 2000; Schollmeyer and Driver 2013; Spielmann and Angstadt-Leto 1996; Szuter and Bayham 1989; Zack-Horner 1999). Ethnographic and archaeological work suggest that the production of meat for feasts might be expected to involve communal hunting activities that target animals that travel in groups and do not hide when startled like jackrabbits (*Lepus* sp.) or pronghorn (*Antilocapra americana*) (see Potter 1997a, 1997b).

James Potter (1997a, 2000) has also argued that another strategy to generate a reliable surplus of meat for communal ritual feasts might involve raising large flocks of domesticated turkeys (*Meleagris gallopavo*). In this study, artiodactyl, lagomorph, and turkey indices are each calculated to address changes in animal food production and consumption, particularly the cooking and consumption of meat at supra-household commensal events. In calculating of each of these indices I followed, Badenhorst and Driver (2009: 1836) in only using assemblages from sites where the sum of the different denominators was at least 50. Faunal assemblages large enough to calculate the indices were available for 34 sites (Appendix C.1).

The lagomorph index uses two genera of lagomorphs, cottontails (*Sylvagus* sp.) and jackrabbits (Szuter and Bayham 1989; Driver and Woiderski 2008). This index has primarily used to understand changes in local landscapes, as jackrabbits prefer open environments while cottontails prefer more covered habitats. However, the lagomorph index, particularly when calculated at intra-site scales, may also be used to assess communal hunting and feasting practices involving jackrabbits (e.g., Potter 1997b). For the lagomorph index, a ratio of one means all lagomorphs in an assemblage are cottontails and a ratio of zero indicates that all lagomorphs are jackrabbits. The lagomorph index is calculated as:

$$\frac{\text{cottontail NISP}}{\text{cottontail NISP} + \text{jackrabbit NISP}}$$

The artiodactyl index (Szuter and Bayham 1989) has often been used to evaluate changes in hunting strategies and to evaluate the resource depression of large-bodied game (e.g., Dean 2001; Badenhorst and Driver 2009; Driver 2002; Potter 2000; Schollmeyer and Driver 2013; Zack-Horner 1999). For the Cibola region, prehispanic artiodactyls included: deer (*Odocoileus* sp.), bighorn sheep (*Ovis canadensis*), elk (*Cervus* sp.), pronghorn, and bison (*Bison bison*). With the artiodactyl index, ratios of one indicate a sample without lagomorphs, while a ratio of zero indicates an absence of artiodactyla. The artiodactyl index is calculated as:

$$\frac{\text{artiodactyla NISP}}{\text{artiodactyla NISP} + \text{lagomorph NISP (cottontails, jackrabbits, indeterminate lagomorphs)}}$$

Finally, the turkey index (Spielmann and Angstadt-Leto 1996; but see modifications by Driver 2002:151-152) as used in this study includes both identified turkeys as well as indeterminate large bird specimens. Many analysts consider large bird specimens to be turkey, as they are the large bird most commonly identified in faunal assemblages. It is unlikely that the inclusion of a few unidentified crane or eagle specimens would inflate the turkey index to a problematic degree in the Cibola region.

Turkey indices have most often been used to compare different regional trajectories of turkey domestication and production intensification over time across the northern U.S. Southwest (e.g., Badenhorst and Driver 2009). Like the artiodactyl index, the turkey index calculates the ratio of turkeys relative to lagomorphs, with a ratio of one indicating lagomorphs are absent in the sample and a ratio of zero indicating turkeys are absent. The turkey index is calculated as:

$$\frac{\text{turkey NISP} + \text{indeterminate large bird NISP}}{\text{turkey NISP} + \text{indet. large bird NISP} + \text{lagomorphs NISP (cottontails, jackrabbits, indet. lagomorphs)}}$$

Archaeological Remains of Foodcrafts

While plant and animal remains provide direct information about the different ingredients consumed in the past, studies of foodcrafts provide critical insights into the activities and techniques that transformed raw ingredients into meals. In the following sections I discuss the groundstone and ceramic data and analyses used in this study to address changes in the nature and scale of different food processing, storage, cooking, serving, and consumption activities in the Cibola region.

Groundstone Data

In this study, analyses of groundstone technologies are used to examine and compare food preparation techniques across the Cibola region through time (Chapter 6). While a wide range of groundstone grinding and pulverizing tools (e.g., mortars, pestles) were likely involved in different stages of processing and preparing meals in the in the Cibola region A.D. 900-1400, in this study I focus solely on sets of manos and metates. Appendix D.1 provides the provenience, type, and measurement data for the metates and metate fragments analyzed for this study, while comparable data for complete manos and mano fragments is available in Appendix D.2. Discussions of manos and metates in this dissertation draw both on ethnographic studies (e.g., Bartlett 1933; Hayden 1987; Nixon-Darcus and D'Andrea 2017; Searcy 2011) and the extensive ethnoarchaeological and archaeological research of groundstone technologies in the U.S. Southwest by Jenny Adams (e.g., 1993, 1999, 2002).

Ethnographic records suggest that most groundstone tools were often made by their users, and in other cases users likely had direct influence on the design of more specialized tools like metates, pallets, *piki* stones, or other griddle-like groundstone equipment (Adams 2002:15; Cushing 1920:321-329; Stevenson 1904:361-362). This suggests that mano and metate design and use data provide a unique source of information about the different daily needs and strategies employed by the individuals or groups processing food for daily household meals and special commensal events. Certain aspects of manos and metates, like form and use-life, can be examined to assess differences in the learned traditions guiding how tools were made, maintained, and used to prepare food. In the U.S. Southwest, metates are often classified into different "types" (e.g., trough, flat) whose design likely indicates different needs for regularly processing different kinds of dried/wet or hard/soft substances (Adams 1993, 1999). Differences in mano wear, profile, and size (see Adams 2002:112-113) are more usefully understood as reflections of mano use-life as opposed to discrete mano "types" or the ubiquitous but largely uninformative distinctions between one- and two-handed manos.

To address changes in cuisine and in the intensity of Cibola food preparation activities through time, I consider four kinds of variables of mano and metate technologies: (1) tool material and (2) length and width measures (on complete tools) for both manos and metates; (3) metate form/type; and, (4) manos use-life data collected by recording the number of used sides and the presence/absence of comfort features. Each of these variables is explained below.

Material and Size

Ethnographic and ethnoarchaeological studies amongst the Maya (Hayden 1987; Searcy 2011), Hopi (Bartlett 1933), and Tigrayan speakers of northern Ethiopia (Nixon-Darcus and D'Andrea 2017), suggest a widespread concern by both groundstone manufacturers and users with the kinds of stone used. The granularity or texture of both manos and metates is an important attribute affecting the efficiency of groundstone tools in rendering materials into finer forms. Selection of raw materials relates to both local accessibility and the needs of the user concerning the durability or ability of the tool to withstand wear (i.e., to maintain a desired roughness and not erode into food) (Adams 2002:20). In the Cibola region manos and metates are largely fashioned from sandstone or vesicular basalt (both coarse and more fine grained), although other materials including quartzite and rhyolite were also sometimes used (see Appendices D.1., D.2.).

Both the weight and the available surface area of manos are important factors in determining the efficiency of grinding activities. Previous studies (e.g., Hard et al. 1996) have used measures of mano surface area to understand changes in the frequency or intensity of grinding and/or agricultural dependence. Increases in the amounts of corn being regularly ground or scheduling conflicts that limit the amount of time that can be devoted to grinding (e.g., Crown 2000c) may encourage the use of tools with larger grinding surfaces. In other words, by increasing the efficiency of grinding toolkits through larger surface areas, an individual would be able to produce more food in less time, or produce larger quantities of food in the same amount of time. While more efficient in terms of time spent grinding, the size of tools is constrained by how much more physical effort the grinder would have to expend by using larger tools, especially larger manos (Adams 1993:483; see also Nixon-Darcus and D'Andrea 2017).

Of particular use for this study, Adams (1999:486, Table 3) has calculated mean mano length and surface area estimates for each metate type across the U.S. Southwest. As might be expected, manos used with more formally designed and highly efficient trough and flat metates are the largest. Appendix D.3 provides a list of all the complete manos analyzed for this study and the length and width measures of their grinding surfaces. As only 16 complete metates were analyzed in this study, grinding surface width and length measurements of these can be found listed in Appendix D.1.

Metate Type and Form

Groundstone classification is best done based on the types of grinding activities involved. Metate types correspond both to established manufacture traditions and to the functional demands of the materials being ground upon them (Adams 2002). Changes in metate type may reflect shifts in the varieties of maize or other materials being frequently ground on them (Adams 1999; Doebley and Bohrer 1983; Snow 1990). In the U.S. Southwest, Adams (2002:100-114) has described four major metate types: basin, slab/concave, trough, and flat (Table 4.2). Across the U.S. Southwest, basin and flat/concave forms were gradually replaced (but not entirely) by more efficient trough metates between ca. A.D. 300 and 500, and later by flat type metates (Adams 1993). The adoption of trough metates, which can effectively contain hard substances as they are ground, may be associated with increasingly sedentary occupations and the grinding of dried kernels. The shift from trough to flat metate types has been associated with changes in the varieties of maize being processed (i.e., flour versus flint types of maize) and with elaborations in the style and complexity of corn dishes being prepared over time (Adams 1993, 1999; Crown 2000c:248; Doebley and Bohrer 1983).

The use of basin and flat/concave metate forms to process foods dates to the Middle Archaic (ca. 5000-1500 B.C.) in the U.S. Southwest (Adams 1993, 2002; Crown 2000c). Processing foods in basin metates usually involves holding a mano in one hand and using circular grinding strokes (Adams 1993). Basin metates are the most comfortable to use as the grinding hand can be alternated and the angle of the strokes varied. Flat/concave metates are metates whose concave shape results from the use of manos that are shorter than the width of the metate. Manos used on flat/concave metates are associated with reciprocal strokes, but show more wear on the ends as the metate becomes increasingly convex with use.

Metates with more formal or strategic designs include trough and flat types. Processing food in trough and flat metates involves holding a mano with both hands and using long reciprocal strokes or often reciprocal-rocking strokes in the case of flat metates. Flat metates are used with manos that match the exact width of the grinding surface and these metates were frequently embedded and used in larger slab or adobe formal mealing features (Adams 2002:112). Flat/concave, trough and flat metates increase grinding efficiency as greater amounts of corn to be ground in less time; however, using these types of metates involves expending more energy and produces greater fatigue because arm and body positions cannot easily be shifted to reduce muscle stress (Adams 1993:338-339). Broadly speaking, experimental studies by Jenny Adams (1993, 1999) suggest that both basin and trough type metates are best suited for containing and reducing foods like hard seeds, nutshell, or kernels with flinty endosperm. Flat/concave and flat metate types are better tools for working with oily or sticky seeds or flours (e.g., sunflower, squash), and working with soaked kernels or maize dough (i.e., *masa*).

Table 4.2. Metate Type/Form Codes and Descriptions of Advantages and Disadvantages.

Code	Metate Type & Form	Advantages	Disadvantages
1	Basin	Grinding strokes can be adjusted to reduce muscle fatigue; suited for grinding hard substances	Small surface area makes grinding less efficient
2	Flat/concave	Larger surface area make grinding more efficient; suited for grinding soft, oily, and soaked substances	Increased muscle fatigue, greater chance of spillage when not used in a mealing bin
3 3.5 4 5	Open trough Indeterminate trough 3/4 trough Utah trough	Larger surface area (but less than flat metates) make grinding more efficient; suited for grinding hard substances	Increased muscle fatigue, mano is smaller than the possible maximal surface area
6	Flat	Larger surface area make grinding more efficient; suited for grinding soft, oily, and soaked substances	Increased muscle fatigue, greater chance of spillage when not used in a mealing bin

Within the metate type distinctions there are also recognized differences in the forms of trough metates. It is thought that these differences are more reflective of technological traditions of tool manufacture than differences in the intended use of the metate (e.g., Adams 1994). There are three different forms of trough metates that were manufactured in the Cibola region A.D. 900-1400 (Table 4.2), though some of these all but disappear by the Pueblo III period (see Chapter 6). With open trough metates the grinding surface is contained by walls on either side leaving both ends open, while three-fourths trough metates have only one end of the trough open. A variation of the three-fourths trough metate is the Utah trough metate where a depression or “mano rest” is pecked into one of the walls.

Mano Use-Life

The design and use-lives of groundstone tools, particularly manos, provide insights into the needs and preferences of individuals preparing food and their embodied motor-habits. In addition, to understand changes in the scale or intensity of food preparation activities the number of used sides on manos can be used to address differences in strategies aimed at enhancing the efficiency and/or intensity of grinding activities. For manos (and metates) patterns of use-life relate to several factors including: (1) the types of substance being ground and the materials selected to do the grinding (i.e., tool form and material), (2) design features and management of tool wear aimed at improving the efficiency and the intensity of the grinding; activities and, (3) the habitual grinding techniques of an individual.

One can think about manos as being found in various “life stages” that can reflect a spectrum of designs and uses from expediently manufactured manos modified only through use, to manos more strategically designed, carefully managed, and personally modified by individual grinders (Adams 2002:21) (Table 4.3). Strategic personal modifications that can be measured on manos often take the form of finger grips fashioned by grinding or pecking grooves on one or both sides of a mano (depending on the motor habits of the grinder). Adams (2002:99) refers to these features as “comfort features” as they are intended to make the mano easier to hold and more comfortable to use when grinding for extended periods. It is possible that large or very heavy manos may often have been modified in this way to make large and efficient (with respect to crushing weight) but also unwieldly tools more usable. Appendix D.2 provides a full list of mano comfort feature data.

Number of Used Sides

In this study the classification of manos is based primarily on the number of used sides present on the tool (Fig. 4.1; Table 4.3). The number of used sides on a mano is most closely related to the strategies of grinders to manage wear on grinding tools or to extend the amount of time a tool can be continuously used before grinding surfaces needs to be refreshed (see Adams 1993: 334-336, 2002:25; Bartlett 1933:15). As manos get worn out they may become less easy or comfortable to use, prompting their users to process foods in ways that extended their use-lives. Individuals may also have been invested in preserving manos of valuable and/or more difficult to obtain materials (i.e., vesicular basalt). Any of these needs on the part of the grinder might result in more careful conservation and wear management on manos. In other cases, increased demands for producing finer and/or larger quantities of meal might have prompted grinders to create multi-sided tools that would wear out quickly but could be used for prolonged or more intense grinding sessions as they offered multiple fresh surfaces to grind with.

If households were expected to produce larger amounts of finely ground foods for large commensal events, this might result in maintaining a set of manos of different materials or with different numbers of usable sides that could be used for different stages of grinding on a given metate (i.e., initial reduction, final processing) and/or to prepare different kinds of flour for different recipes (i.e., course versus fine maize flours). Sets of multiple manos of different materials used on the same metate have been recorded at several prehispanic settlements in the Cibola region (e.g., Adams 2002:119; Bradford

1980; Martin and Rinaldo 1960). A description of each mano type with respect to its number of used sides, wear management, and its potential use for long grinding sessions is provided below.

Table 4.3. Mano Codes and Descriptions of Extended versus Intensive Use Strategies.

Code	Number of Used Sides	Management for Wear (extended use)	Management for Longer Grinding Sessions (intensive use)
A	1	Low	Low
B		Moderate, vertically flipped	Moderate
C	2	High, vertically flipped, proximal and distal ends rotated	Moderate
D		Moderate, proximal and distal ends rotated	Moderate
E	3	Moderate, refreshing multiple sides reduces tool faster	High, multiple surfaces allow longer use without refreshing
F	4	Moderate, refreshing multiple sides reduces tool faster	High, multiple surfaces allow longer use without refreshing

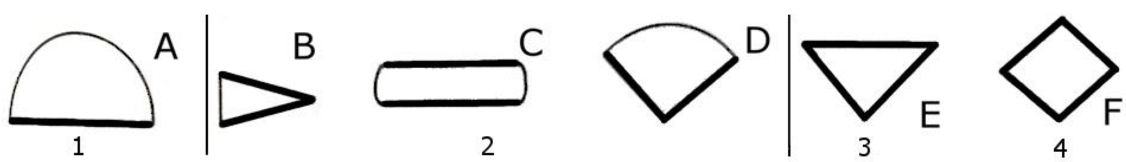

Figure 4.1. Mano Wear Profiles (modified from Adams 2002, Fig. 5.12).

- *One Used Surface*

Type **A** manos have only a single used surface and sometimes a shaped convex upper surface to fit the hand of the grinder. One drawback to this design is the need to frequently "refresh" or roughen the single available grinding surface.

- *Two Used Surfaces*:

Type B, C, and D manos were each ground on two sides. Manos managed in this way could be flipped, flipped and rotated, or rotated to provide a fresh grinding surface once one side became too smooth. **B type** manos with a wedge-shaped profile (Fig. 4.1) may indicate motor habits involving a grinding stroke where strong proximal pressure was being exerted on the handstone with the downward stroke, and in some instances these manos show wear that would result from grinding with a rocking motion. Type **C** manos are two sided manos that are managed in two different ways to maintain a rectangular profile and two flat surfaces. This is achieved by both vertically flipping and rotating the proximal and distal ends of the mano to prevent the surface from becoming uneven. Of the two-sided manos this type shows the most careful management of tools. Type **D** manos have to two adjacent surfaces. This wear pattern comes from rotating the proximal and distal ends. Overall, differences in grinding strokes and methods of wear management on these manos with two-used surfaces may reflect different learned motor habits (Adams 1993:334-340; Bartlett 1933:15-16).

- *Three/Four Used Surface*

Type **E** manos have two adjacent and one opposite used surfaces and type **F** manos have four adjacent surfaces. These tools show signs of extreme use and potentially reflect a higher concern with maintaining numerous usable grinding surfaces for long periods of grinding. While this wear pattern on the tool indicates it provided many usable surfaces, both E and F manos would not be as comfortable to use as two sided manos with larger areas preserved to protect fingers from becoming abraded. The presence of E and F type manos may indicate households producing large quantities of fine maize flour, it is also possible these tools were more often used in the later stages of fine cornmeal processing (as opposed to the initial crushing of kernels). I expect that a shift in cuisine involving a greater use of finely ground flour would be reflected in increasing percentages of three and four sided manos in household grinding toolkits.

Ceramic Vessel Data

Archaeological studies often utilize ceramic vessel form and size data to understand the nature and distribution of food preparation and consumption activities and to investigate the size of the social groups engaged in them (e.g., Blinman 1989; Blitz 1993; Ortman and Bradley 2002; Mills 1999; Graves and Spielman 2000; Varien et al. 2017). To examine spatial and temporal patterns in the nature and scale of food storage, cooking, serving and consumption activities, seven different variables of ceramic vessel body and rim attributes were collected on decorated and undecorated ceramic jars, bowls, and ladles from each of the core settlements. Table 4.4 provides a list of the variables recorded for all analyzed sherds and specific variables measured on body and rim sherds (Appendix E).

Table 4.4. All Variables Measured on Ceramic Vessels.

Vessel Portion	Variable	Description
All sherds	Ware/Type	Standard ceramic ware/type name
	Vessel Portion	Body sherd, rim
	Vessel Form	Jar, bowl, ladle, other
	Vessel Treatment	Presence/absence of interior smudging and polishing
	Heat Exposure	Presence/absence of burning and charring
Body sherds	Vessel Curvature	Curvature measures on body sherds larger than 8 cm
Rim sherds	Rim Diameter	Measured with standard rim radius template
	Rim Form	Flaring, straight, inverted, recurved, etc.

Ware/Type and Vessel Portion

For each ceramic sherd standard ware (e.g., Cibola White Ware) and type (e.g., Tularosa black-on-white) information was recorded. Ware and type information are useful as extensive ceramic studies in the U.S. Southwest suggest certain wares and types were associated with different food activities such as cooking, and storage. Especially in the case of ceramic bowls, certain wares were exchanged over great distances and likely had special symbolic importance and a prominent place in feasting activities (e.g., Graves and Spielmann 2000; Mills 2007; Peeples 2018; Spielmann 2004; Van Keuren 2004). Intra- and inter-site analyses of ratios of redware to other decorated and undecorated vessels in the U.S. Southwest have also been done to examine differences in the nature and scale of food consumption and cooking activities at finer spatial scales (e.g., Blinman 1989).

Vessel portion indicates what section of the vessel is being recorded (e.g., rim, body sherd). Measurements of complete or largely complete vessels were also noted. Finally, for undecorated jars which were either corrugated Cibola Gray Ware or Mogollon Brown Ware vessels, additional information about the type of corrugation (e.g., indented, obliterated) was recorded (Appendix E.1).

Vessel Form

Studies of ceramic vessel form are often used to assess the range and spatial distribution or frequency of different activities at a settlement over time. The basic assumption for such studies is that the forms and sizes of ceramic vessels are related to their intended use. This is supported by several ethnoarchaeological studies (e.g. Nelson 1981; Skibo 1992). In the U.S. Southwest decorated jars are typically associated with storing food and water, decorated bowls with the serving and consumption of food, and undecorated jars with cooking and sometimes storage activities (e.g., Chamberlin 2002). The ceramic sherd data collected from each site in this study are organized by vessel form into four appendices: undecorated jars body sherds and rims (Appendix E.1); decorated jar body sherds and rims (Appendix E.2), bowl rims (Appendix E.3); and ladle rims (Appendix E.4).

Vessel Treatment and Heat Exposure

Vessel treatment refers to the presence or absence of interior smudging and polishing of ceramic vessels. Smudging is a technique used during the firing of ceramic vessels that leaves a black, iridescent, and smooth coating on the interior of vessels that has been attributed with beneficial antibacterial and fungicidal properties (Rogers 1980; but see Stone 2018). This form of vessel treatment was a tradition largely practiced on Mogollon Brown Ware bowls and more rarely on jars by populations living in southern portions of the Cibola. Barbara Mills (2007a:216) has suggested that the presence or absence of smudging on bowls may mark, “a fundamental difference in cuisine.”

Interior polishing indicates a highly polished vessel interior, which again is a ceramic manufacture tradition typically associated with Mogollon Brown Ware jars and bowls. Together smudging and polishing are thought to reduce the porosity or season the interior surfaces of ceramic vessels, something that would make heating vessels and their contents much more efficient and may make the vessels themselves more durable (Pierce 1999; Schiffer 1990; Schiffer et al. 1994). Heat exposure indicates the presence or absence of evidence for the direct heating of vessels and the presence of carbon deposits (i.e., soot) on the *exterior* of ceramic vessels. Sherds with evidence for heat exposure on the interior or along the edge of sherds are more likely to have been burned by a structural fire than through use in cooking. To examine spatial and temporal patterns in cuisine, specifically food storage, cooking, and serving practices, each of these variables was measured on undecorated jar (Appendix E.1) and bowl (Appendix E.3) sherds.

Vessel Curvature, Rim Diameter, and Rim Form

In addition to form data, information collected about the size of different vessels can be used to examine the nature and distribution of food activities in space as well as the size of the social units that may have engaged in such activities (e.g., Hally 1986; Blinman 1989; Blitz 1993; Lesure 1998; Mills 1999; Graves and Spielman 2000). In this study I use size measurements of ceramic vessel body sherd curvature and rim diameter on decorated and undecorated jars to understand changes in the organization and scale of food storage, preparation, and cooking activities. For bowls and ladles, rim diameters were measured to evaluate patterns in the size of these vessels and to address how the scale of household and supra-household commensal activities persisted or changed through time. Rim forms were also recorded as these can indicate important morphological differences in the performance characteristics of different ceramic vessel forms, including pouring ability and access to vessel contents. Rim forms can also be used to detect the presence of more specific vessel forms (i.e., seeds jars). Overall, to examine patterns in the scale of commensal activities measures of the size of cooking and serving vessels likely provide a more direct indicator of consumer group size than measures of storage vessels (Mills 1999:102).

The size of ceramic vessels is usually estimated using measures of vessel orifice diameter and vessel height on whole or nearly whole vessels[1]. When a strong relationship exists between vessel volume and orifice diameter, rim-arc data from incomplete vessels can be used as a reasonable proxy for vessel size. However, it has traditionally been difficult to address changes in the size of ceramic cooking vessels because corrugated and plainware jars (especially large jars) are rarely recovered in complete or reconstructable forms. While rim-arc data from fragmented vessels can be used to estimate vessel size, relationships between vessel volume and orifice diameter are strongest for ceramic bowl and ladle forms and more problematic for jars, especially as decorated jars in the northern Southwest typically have very restricted openings.

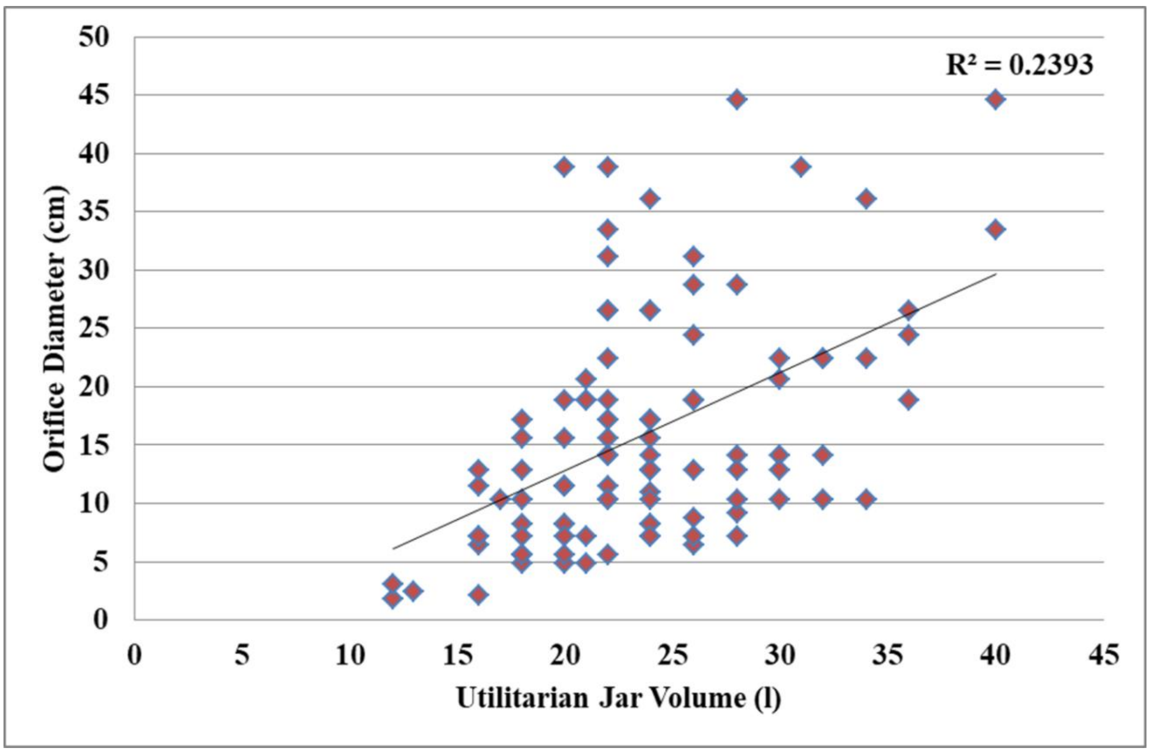

Figure 4.2. Comparison of Cibola Cooking Jar Orifice Diameters to Body Sherd Volume Measures of Reconstructable Jars (n=105).

Another possibility for obtaining measures of jar volume involves using measures of body sherd curvature on large jar sherds. Experimental studies with whole broken vessels of known volume, suggest this method provides a more direct measure of vessel volume than orifice diameters alone as long as basic assumptions about vessel shape can be made (i.e., that is the vessel body is roughly spherical in shape). In an experimental study, spherical estimates of sherds larger than 6 cm were able to accurately separate sherds into different vessel size modes 90% of the time and overestimated the actual volume only 5% (Peeples n.d.).

For this study of ceramic cooking vessel volume, slightly larger (i.e., larger than 8 cm) sherds were selected and measured using a contour gage. Measurements of body sherds were made along their longest axis and perpendicular to the longest axis, as different portions of sherds may have somewhat different curvatures. Each of these measures was fit against a template of concentric circles to get an estimate of the spherical diameter of the sherd. Curvature measures were averaged and used to calculate the approximate spherical volume of the jar. These volume estimates are reported for corrugated (Appendix E.1) and decorated (Appendix E.2) jars.

Measurements of corrugated jar orifice diameters from Pueblo III and IV period sites in the El Morro Valley (Potter 2000:485, Table 1) have been used to suggest an increase over time in the frequency of "large" (i.e., rim diameters > 24 cm) versus "small" cooking jars. The relationship between orifice diameter and vessel volume estimated with the body sherd curvature technique were tested on 105 reconstructable corrugated jar vessels from the Cibola region (Fig. 4.2). As expected, small jars generally had smaller orifice diameters; however, rim diameters for larger cooking jars (i.e., jars with volumes above 20 liters) were far more variable. These results suggest that orifice diameters of cooking jars when used alone may mask important variation in the size and morphology of large cooking jars and thus in the scale of cooking activities and possibly the range of cooking techniques that were associated with utilitarian jars of different shapes (Chapter 7).

Archaeological Remains of Food Preparation and Cooking Features

The design and uses of domestic architectural spaces and features provide information about household organization, labor, gender, and about the nature and social context of food activities over time (e.g., Adams 2002; Crown 2000b; Lowell 1999; Ortman 1998). In addition, examining patterns in the design and materials associated with domestic architectural features like hearths and grinding facilities can provide important insights into differences in cuisine, food processing and cooking techniques, and more generally into the scale of the food production and cooking process at intra- and inter-site scales through time (e.g. Lowell 1995; Sobolik et al. 1997). The architectural data employed in this dissertation came from a mixture of sources including excavation field notes, published manuscripts (e.g., Martin et al. 1964, 1967), and previously compiled databases of intramural domestic architectural features (Ortman 1998; Peeples 2011: 225-251).

Thermal Features

Thermal features are important sources of information about food processing and cooking as well as helpful sources of information about the organization and daily uses of intramural and extramural space, social organization (e.g., James 1994:250-252), and even about cuisine (e.g., Snow 1990) and social identity (e.g., Peeples 2018). In this dissertation I draw upon published site descriptions, unpublished field notes, and previous studies (Lowell 1999; Peeples 2011: 225-251) of thermal features to compare patterns in: (1) the type and placement of intramural and extramural thermal features; (2)

the area and volume of these features; and, (3) any additional components or materials associated with the use thermal features (e.g., ash features, pot rests etc.) (Appendix F.1).

Similarities in design and placement of hearths may provide some indication of underlying similarities in the organization of domestic activities. Intramural hearths were important sources of heat and lighting as well as the locations of numerous food preparation and cooking activities. Ethnographic and paleoethnobotanical data suggest that these features were used for a range of purposes, including for different cooking techniques involving roasting, parching, boiling, and baking (e.g., Cushing 1920; Lowell 1999; Stevenson 1904).

Hearths across the Cibola region are largely rectangular slab-lined types, though hearth types vary at times even within settlements. This diversity in hearth types may signal differences the intended function of the features, cooking styles, or in the scale of cooking activities or the size social groups using them. While hearth dimensions may provide information about the scales or nature of cooking activities (Crown 2001c:258-259); the kinds of cooking, baking, and roasting done to provide food for large commensal events often likely occurred in outdoor features or in dedicated architectural spaces like Hopi *piki* houses (Adams 1983; Cushing 1920; Dedecker 2005; Lowell 1999).

For domestic thermal features, placement information provides a sense of how daily cooking activities and interactions would have been structured. More centrally located cooking features would have allowed individuals cooking to more easily engage with others. Previous studies of hearth placement suggest that northern Cibola settlements more often constructed hearths along the walls or in room corners, while hearths in more southern area are nearly always placed in the centers of rooms (Peeples 2011:241-246).

Table 4.5. Thermal Feature Type Codes and Description (modified from Peeples 2011, Table 7.2; Lowell 1999, Table 1).

Code	Thermal Feature Type	Description
A	Rectangular slab-lined	Rectangular pit excavated into floor surface with stone slab sides that extend well above the floor (often with slab-lined bottoms)
B	Circular/irregular slab-lined	Circular or irregular pit excavated into floor with stone slab sides that extend well above floor (often with slab-lined bottoms)
C	Clay lined pit with stone rim	Pit of any shape excavated in the floor and lined with a thick layer of clay. The exterior rim may be lined by horizontal slabs or small stones
D	Clay lined pit, no rim	Pit of any shape excavated into floor and lined with a thick layer of clay
E	Pit with raised adobe coping	Pit of any shape excavated into the floor with raised adobe coping that extends well above the floor surface
F	Extramural Hearth	Rectangular pit excavated into surface lined with stone slabs or clay
R	Extramural Roasting Pit	Extramural thermal feature of any shape excavated into ground surface (often filled with fire-cracked rock).

In addition to the construction style, the inclusion of additional architectural features like pot-rests and ash features can provide important information about cooking techniques (Dedecker 2005; Lowell 1995, 1999). In this study I use the term pot-rest though there have been a number of different terms (i.e., firedogs, trivets, andirons, pot supports) given to the stones found associated with cooking features. These stones are thought to have assisted in cooking activities by controlling the flow of air to fuel sources and/or moderating the heating of ceramic vessels or stone cooking implements (i.e., griddles or *piki* slabs) (e.g., Adams 2002:231; Martin and Rinaldo 1960:256; Snow 1990). Ash features may have been constructed to keep supply of culinary ash handy for preparing different maize dishes, they may also have been used to toast and bake foods (Cushing 1920:294-295).

Mealing Bins

The construction and design of grinding features provide important insights into the nature and organization of food processing activities. Mealing bins appear in the Cibola region likely sometime in the Pueblo II period (e.g., Damp and Wasseta 2004; Roberts 1932). As permanent grinding stations they reflect the dedication of certain spaces to food processing activities and perhaps increases in the amount of time being spent by women grinding. While single bins allow only one person to process food at a time, multiple bins allow several grinders to work together and to each work at a different stage of grinding maize into finer and finer flour in an assembly-line like fashion (Adams 2002:116). Differences in mealing bin construction have been previously examined in the Cibola region and as with the thermal features, mealing bin traditions vary across the Cibola region (Peeples 2011:246-251). While slab-lined bins are the most common type recorded across the Cibola region, southern Cibola settlements also constructed features using adobe coping to house metates. In some southern areas dedicated receptacles (bowls set in adobe) were used to catch flour, in the north skins or baskets may have been used instead (Chapter 6).

Chapter Summary

Addressing relationships between food and social transformations requires a multi-scalar comparative perspective that can situate daily food activities and decisions into broader socioeconomic, political, and environmental contexts through time. While the finished forms of foods themselves are rarely accessible to archaeologists, many other aspects of meals and food activities can be productively addressed through examinations of the remains of staple plant and animal ingredients, the vast array of tools and embodied techniques used to produce and prepare meals, the spaces associated with food preparation and consumption activities. In the proceeding chapters, I use the databases of plant and animal ingredients, the groundstone and ceramic vessel tools, and thermal and mealing features presented in this chapter to address histories of cuisine and changes in the scales of food production and consumption across the Cibola region A.D. 900-1400.

Chapter 4 Notes

[1] A related issue with much of the published ceramic vessel volume data in the U.S. Southwest is that many of the large whole vessel collections studied in museums are recovered from burial contexts. As these vessels may have been produced and deposited for burial specific reasons, they likely provide a distorted view of the actual range of sizes of different vessel forms used in domestic or other contexts within settlements in the past.

Chapter 5:

CORN RAISING; CIBOLA FOOD PRODUCTION

"*In all aspects, production is a social act… A person's intentions in these acts are multiple, engaging with material resources, a social process across a landscape of practice (Hastorf 2016: 84).*"

In the U.S. Southwest and across the discipline more generally, research on food has traditionally focused on production activities and subsistence strategies, with special attention paid to processes of plant and animal domestication and the transition to or intensification of agricultural economies (Hastorf 2016; VanDerwarker et al. 2016). Examining the interplay between food production practices and broader processes of sociopolitical and environmental change requires considering a wide range of factors that might influence the intensity and/or organization of production (Chapter 2). Food production involves a mixture of daily and seasonal tasks: planting, gathering, tending, or otherwise caring for plants and animals. These activities encompass numerous of actors, strategies, tools, and places. Decisions surrounding the amounts of food planted and procured involve a range of different needs, desires, and strategies relating to anticipated yields, storage capacity, risks of crop-failure, and participation in broader social life and the political economy.

In this chapter I draw on a mixture of ethnographic, botanical, and faunal data to establishing baselines and compare trajectories in the production of different plant and animal foods across the Cibola region through time. To address continuity and change in cuisine across the Cibola region, I begin with an examination of the production and use of staple domesticated foods, focusing especially on the varieties of maize being grown and changes in the management of turkeys. I then compare the use of signature gathered foods and flavoring across the region through time. In the final portion of the chapter I use a mixture of plant ubiquity measures and standardized faunal indices to consider how processes of population aggregation and settlement growth and nucleation were linked to intensification in food production practices across the Cibola region.

Ethnographic and Archaeological Evidence for Food Production

Several excellent summaries of the rich ethnographic record of 19th century Zuni agriculture written by Cushing (1920) and Stevenson (1904, 1915) have already been published (Bohrer 1960; Kintigh 1985:90-102; Muenchrath et al. 2002). As such, I engage only briefly here with the details of these ethnographic sources as they relate to particular aspects of agricultural strategies and the organization of labor historically at Zuni Pueblo. Cushing (1920) provides a detailed account of both dry-farming and river and spring-irrigation practices at Zuni in the late 19th century. Common dry-farming strategies involved selecting field sites that would receive runoff (1920:152-153), creating check-dams (1920:157-160), and making embankments and barriers to control water and soil movements across fields (1920:165). Cushing also provides some discussion of the irrigation systems at *Doy'a* (Nutria) (1920:364-366), where farmers maintained cooperative systems of water management and used log and open-ditch irrigation channels to plant in large (3x4m.) earthen grids. Stevenson (1904:351-353) provides a similar description of spring irrigation with open-ditch channels at *K'ya'na* (Ojo Caliente), although she disagrees with Cushing as to the degree to which water usage was monitored and cooperatively organized. Clearing fields, planting, and maintaining springs and gardens were regular communal activities at Zuni Pueblo until recently (P. Peynetsa, personal communication, August 23, 2018), and farmer associations still cooperatively manage and maintain springs, canals, and irrigation schedules at the major Zuni farming districts (Bowannie et al. 1994; R. Chimoni, personal communication, August 21, 2018).

Across the Cibola region, recorded water and soil control features dating from the Pueblo II to Pueblo IV periods consist of check-dams, gridded and mulched fields, diversions, irrigation canals, and terraces (Black n.d.; CARP notes, Damp et al. 2002; OBAP notes; Stone 1991). Archaeological evidence indicates that river and spring irrigation agriculture has been practiced in the Cibola region to some degree for at least 3000 years (Damp et al. 2002; Muenchrath et al. 2002; Norton et al. 2003; Prevost et al. 1993). The long history of diverse water and soil control strategies recorded at Zuni highlights the regular need of farmers to accommodate highly variable climatic conditions. It also suggests that some level of cooperative management and labor were often involved in expanding and maintaining irrigation agricultural infrastructure in the past. Finally, while the gathering and hunting of a diverse range of food plants and animals in the Cibola region occurred over a vast area (Ferguson and Hart: 1985:43-47), prior to the introduction of donkeys and carts agricultural fields and gardens would likely have been located within a few hours walking distance of villages and towns (see Kintigh 1985:104-109).

Domesticated Plant and Animal Foods 900-1400 A.D.

By A.D. 900, farmers in the Cibola region had long been growing maize as their principal crop, as well as several additional Mesoamerican domesticates including pumpkins and common beans (see Chapter 4, Table 4.1). Across the northern U.S.

Southwest, the Pueblo III period is associated with a significant increase in the number of domesticated crop varieties being grown (Adams and Van West 2005:37.14). In the Cibola region, cushaw squash, winter squash, and tepary beans were each added to the existing repertoire of cultivars in the 12th or early 13th century. In settlement areas along the Western Puerco and Upper Little Colorado areas, lima beans and possibly jack beans (*Canavalia ensiformis* (L.) D.C.) have also been identified at Pueblo III and IV period settlements (Burton 1990; Cutler 1964). Macrobotanical and pollen evidence suggests Cibola farmers were also potentially cultivating limited quantities of cotton[1] (*Gossypium hirsutum* L.) in areas along the western and southwestern edges of the Cibola region. Overall, regional increases in crop diversity in the 13th century suggest that farmers in the Cibola were connected to broad networks of seed and crop-knowledge exchange. This may have been especially true for populations in the Upper Little Colorado and more western portions of the Cibola region.

Varieties of Maize

Maize has long been the dietary staple and culinary heart of Zuni cuisine. Historically, six colors of both corn and beans were grown at Zuni both for daily consumption and also for a wide variety of ceremonial uses (Bohrer 1960; Cushing 1920; Stevenson 1915). Cushing (1920:36) describes the different colors of maize as each corresponded with a corn maiden ranging from eldest to youngest; yellow, blue, red, white, speckled, black, and finally sweet corn. As color data is rarely available (Chapter 4), charred maize cob row-numbers and other cob and kernel morphological attributes, including kernel endosperm, have instead often been used to assess patterns in the growth of different prehispanic maize landraces in the northern U.S. Southwest.

Table: 5.1. Recorded Cibola Maize Landrace, Row Number, and Kernel Endosperm Characteristics A.D. 900-1400 (after Adams 1994, Table 16.1).

Landrace[1]	Row No.	Endosperm Type
Chapalote	12-14	popcorn, flint
Reventador	12-14	flint
Onaveno[2]	10-16	flint
Mais (Harinoso) de Ocho	8	flour
Mais Blando[2]	12-14	flour
Pueblo	12-14	flour

[1]Listed in order of earliest appearance in the U.S. Southwest (see Adams 1994:293, Table 16.9)
[2]The Pima/Papago Complex

Endosperm type as used here refers to major distinctions in the texture of kernel endosperm (the starchy interior tissue of kernels) in different maize varieties. This characteristic of maize kernels plays a major role into decisions about maize storage, preparation, and cooking practices. Kernel endosperm types range from hard and corneous with popcorns, to course and soft with flour kernel types, and a mixture of soft interiors surrounded by an exterior corneous layer with flint corns. While the corneous kernel endosperm layer lends flints and popcorns some protection from pests and spoilage, these kernels are harder to grind and toasting, soaking, and boiling may have been the preferred preparation and cooking techniques employed for these varieties of maize (Crown 2000: 252; Doebley and Bohrer 1983). In contrast, flour types of maize are more prone to spoilage and pest destruction, but their soft-floury endosperm make them easier to grind and thus likely the preferred type of maize to use when producing bread and mush recipes requiring finer flours (Adams 1999; Doebley and Bohrer 1983).

A diverse mixture of maize landraces, including popcorn, flint, and flour kernel endosperm types have been identified from Cibola settlements A.D. 900-1400 (Cutler 1964; Miksicek n.d.) (Table 5.1). While these analyses suggest that flint and pop types of maize continued to be grown in the Cibola region throughout the Pueblo III and IV periods, several studies of row-number suggest that increasing proportions of eight-row maize were produced over the 13th century (Cutler 1964; Miksicek n.d.). Examining patterns in maize cob row-numbers across the Cibola region through time (Fig. 5.1), there is a significant relationship between maize cob row number the temporal period of cob assemblages (X^2=233.5, df=6, p<0. 001). The degree of overlap or ambiguity in the row number ranges reported for major flour (8, 12-14) and flint and pop (10-16) row landraces (Table 5.1) however, make it somewhat difficult to interpret changes in the percentages of cobs with 10-12 rows in terms of relative changes in the amounts of flint/pop or flour types of maize being grown.

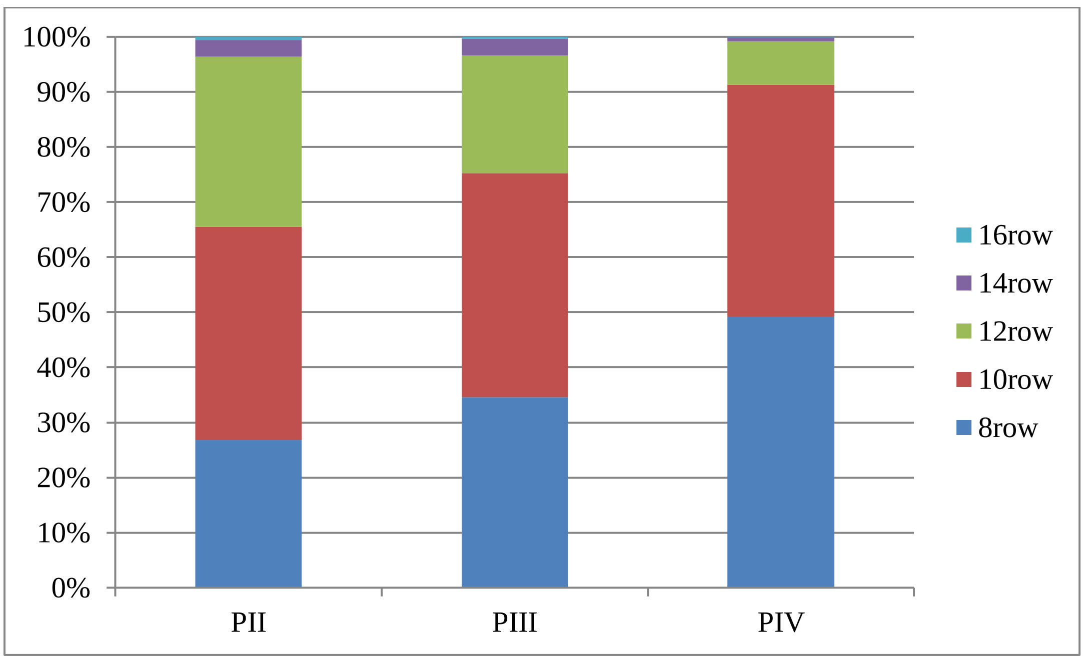

Figure 5.1. Percentages of Maize Cob Row-Numbers A.D. 900-1400

Looking at just the percentage of eight-rowed maize cobs, most likely the flour Mais de Ocho type, higher percentages of eight-rowed maize cobs can be observed in collections of cobs from Pueblo III and especially Pueblo IV period sites (Fig. 5.1). The difference in the percentage of eight-rowed cobs in Pueblo II through PIV period cob assemblages is significant (X^2=109.2, df=2, p<0.001). This pattern in maize cob row-number indicates that Cibola farmers grew larger quantities of eight-rowed likely flour varieties of maize and smaller quantities of flint or pop types through the 12th and 14th centuries. I argue that this shift in maize production was related to shifts in cuisine and the increasing importance of preparing fine-flour maize breadstuffs in aggregated villages and nucleated towns, a topic I return to in Chapter 6.

While limited comparable data exist, the shift in maize production and cuisine documented for Cibola region may have occurred in other portions the northern U.S. Southwest in the Pueblo III and IV periods. Similar decreases in the percentage of higher row-numbered flints and a simultaneous increase in eight-rowed likely flour varieties has previously been documented for several sites in the San Juan and Mesa Verde regions over the 12th through 13th centuries (Cutler and Meyer 1965; Doebley and Bohrer 1983). John Doebley and Vorsila Bohrer (1983) noted that not only did the row numbers of maize cob decrease at Salmon Ruin through the 13th century, but that there was a related, parallel shift in groundstone technologies. Specifically, Doebley and Bohrer documented increasing proportions of flat metate to trough metate types in later occupation periods. While trough metates are ideal for containing kernels of varieties of maize with harder endosperms (e.g., flint, pop), these walls are unnecessary when grinding kernels of softer flour types of maize (Adams 1993; Doebley and Bohrer 1983; Chapter 4). Doebley and Bohrer suggest this shift in groundstone technology was linked to broader changes in maize preparation and consumption practices, with more flints and popcorns being coarsely processed and boiled in earlier occupation periods and more flour varieties of maize being finely ground to create mushes, puddings, or other breads in later periods

(1983:35). As I will discuss in the following chapter, increases in the production and consumption of flour maize types are also associated with an increase in the manufacture and use of flat metate types across the Cibola region (Chapter 6).

Turkeys

Limited excavation of late Basketmaker III and Pueblo I (ca. A.D. 600–900), period settlements makes it difficult to evaluate the precise origin and early trajectory of domesticated turkey keeping in the Cibola region. Both bone and eggshell from hunted or perhaps captive turkeys have been recovered from sites dating from these periods onwards (Adams and Van West 2005: 37.13). However, inconsistencies in sampling and recording of key variables, like the presence of pens, dung, and unhatched eggs (see Senior and Pierce 1989), make it difficult to evaluate the nature and extent of early turkey management across the Cibola region.

From at least the Pueblo II period onwards, a mixture of archaeological (Table 5.2) and ancient DNA (Speller et al. 2010) data, supports arguments that domesticated turkeys were being raised at settlements across the Cibola region. The presence of eggshell is the most frequently recorded indicator of turkey husbandry across the Cibola region, although concentrations of poults and healed injuries are also common (Table 5.2). The majority of eggshells at Cibola settlements were recovered from middens, perhaps indicating a degree of consumption of turkey eggs. Concentrations of eggshells and poults have also been recorded in masonry rooms and occasionally kivas and suggest that these spaces may have a long history being repurposed and used to breed and keep domesticated turkeys at settlements in the Cibola region (Martin et al. 1967; Museum of Northern Arizona notes; Olsen 1990; Zack-Horner 1999). Overall, several lines of evidence support arguments for a longstanding investment in domesticated turkeys husbandry in the Cibola region dating at least to the Pueblo II period. In the final section of this chapter, I discuss evidence for the intensified production of domesticated turkeys across the Cibola region in the late 13th and early 14th centuries.

Table 5.2. Archaeological Indicators of Husbandry in the Cibola Region.

Period	Sub-Region	Site Name	Eggshell	Unhatched Eggs	Pens	Dung	Poults	Healed Injuries
PII	Mariana Mesa	Cox Ranch	X					
PII	Mariana Mesa	Largo Gap	X				X	
PII	Central Zuni	NM:12:K3:101						
PII	Central Zuni	NM:12:K3:102				X	X	
PII	Central Zuni	NM:12:K3:213						
PII	Central Zuni	LA 129241	X	X				
PII	Central Zuni	H-Spear						
PII	Puerco West	AZ K:15:16	X				X	
PII	Puerco West	AZ K:15:17	X					
PII	Silver Creek	Hough's Great Kiva					X	
PII	Silver Creek	Cothrun's Kiva						
PIII	El Morro Valley	LA 132353	X					
PIII	El Morro Valley	Los Gigantes	X		X			
PIII	El Morro Valley	Pettit	X					
PIII	El Morro Valley	Scribe S	X					X
PIII	El Morro Valley	Tinaja						X
PIII	Central Zuni	NA 11,527	X				X	X
PIII	Central Zuni	Hinkson	X					X
PIII	Central Zuni	Jaralosa						
PIII	Central Zuni	NA 11,530	X				X	X
PIII	Silver Creek	Pottery Hill					X	
PIII	Upper Little Colorado	Rudd Creek						
PIV	Arizona Mountains	Grasshopper	X				X	
PIV	El Morro Valley	Atsinna						X
PIV	El Morro Valley	Mirabal						X
PIV	El Morro Valley	Pueblo de los Muertos	X					X
PIV	El Morro Valley	Cienega						X
PIV	Mariana Mesa	Techado Springs	X				X	
PIV	Central Zuni	Heshot uła	X					X
PIV	Central Zuni	Lower Pescado						
PIV	Central Zuni	Ojo Bonito						
PIV	Puerco West	Puerco Ruin						
PIV	Silver Creek	Bailey Ruin					X	
PIV	Upper Little Colorado	Baca						
PIV	Upper Little Colorado	Rattlesnake	X					

Hunted and Gathered Foods

Aside from beans, the primary sources of dietary protein for populations in the Cibola region would have come from hunted large and small-bodied game (e.g., deer, rabbits) or domesticated turkeys (Table 5.3). The most commonly consumed source of meat was likely some kind of lagomorph (i.e., cottontail, jackrabbit) or rodent (e.g., groundhog, prairie dog, squirrel). Consistently high indices of both turkeys and artiodactyls, however, may indicate the relatively common consumption of these foods in the Cibola region at least in several upland settlement areas (Adams and Van West 2005; Zack-Horner 1999). Previous comparative examinations of artiodactyl availability in the Mesa Verde, Mimbres, and Cibola regions have noted that Cibola settlements were unusual in that they sustained, "relatively high access to artiodactyls" (Schollmeyer and Driver 2013:464). I compare and discuss patterns in Cibola artiodactyl procurement and intensified turkey production following population aggregation and settlement nucleation in the final section of this chapter.

Table 5.3. Cibola Animal Food Taxa A.D. 900-1400.

Scientific Name			**Common Name**
Class	Order	Genus/Species	
Aves	Columbiformes	*Zenaida macroura*	dove
	Galliformes	*Meleagris gallopavo*	turkey
		Callipepla sp.	quail
	Piciformes	*Colaptes* sp.	flicker
Mammalia	Artiodactyla	*Antilocapra americana*	pronghorn
		Bison	bison
		Odocoileus sp.	deer
		Ovis canadensis	bighorn sheep
	Rodentia	*Cynomys* sp.	prairie dog
		Sciurus sp.	squirrel
		Spermophilus sp.	rock squirrel
		Neotoma sp.	woodrat
		Thomomys sp.	pocket gopher
	Lagomorpha	*Lepus* sp.	jackrabbit
		Sylvilagus sp.	cottontail
Osteichthyes			fish

Direct archaeological evidence is more limited for the preparation and consumption of several smaller rodent (e.g., woodrat) and bird species (e.g., dove) that ethnographic records suggests were commonly consumed by the Zuni and at other

Pueblos (e.g., Cushing 1920; Gnabasik 1981). While the presence of butchering marks and/or burning or browning on bones are often used to document and examine the preparation and cooking of animals in the past, this method is most reliable for larger mammal or avian taxa (Chapter 7). Overall, a similar range of hunted and domesticated animal foods were consumed across Cibola region A.D. 900-1400. The one exception to this is bison, which was recovered largely from more southeastern Cibola settlement areas (i.e., Mariana Mesa) and, interestingly, in the Upper Little Colorado area (Casa Malpais Museum notes; DeGarmo 1975; Tawater 2009).

Encouraged and Gathered Plants

Synthetic studies of archaeological plant remains have previously been used to address regional differences in cuisine across Hohokam settlements in central and southern Arizona (Gasser and Kwiatkowski 1991). While maize was the major staple crop across the Hohokam region, differences in the ubiquity of agave, beans, mesquite, and domesticated little barley (see also Adams 2014) suggest a degree of sub-regional variation in agricultural strategies and the extent to which certain plant foods were cultivated. Of particular interest in terms of addressing patterns in cuisine, there were also localized differences in the use of several cultivated or gathered "signature" plants and flavoring agents (e.g., milkvetch, plantain, tansy mustard) that could not be explained by differences in habitat (Bohrer 1987; Gasser and Kwiatkowski 1991).

To examine similar patterns in the use of gathered and signature flavoring ingredients across the Cibola region, Table 5.4 provides a list of the most commonly recovered Cibola plant food taxa, or those recorded as present in at least 20% of sites[2]. Two additional plant taxa, manzanita and oak are also included in Table 5.4 because they were recovered in more than half of settlements in the Silver Creek and Arizona Mountain areas and suggest a particular local focus on these taxa. With the exception of walnut and manzanita, each of the above listed “common” plant foods would have been locally available to some degree to settlement areas across the Cibola region. For each species, Table 5.4 also denotes whether or not each plant food has been recovered from human coprolites and if they have been recorded as an ethnographic staple food in the U.S. Southwest.

Table 5.4. Common Plant Food Taxa in the Cibola Region A.D. 900-1400.

				x=present > 50% of sites					
	Taxon	**Coprolite Recovery** (Gasser 1982; Minnis 1989)	**Ethnographic Staple** (Moerman 2003)	Central Zuni	El Morro Valley	Puerco West[1]	Silver Creek / AZ Mountains	Upper Little Colorado	**Percentage all sites** (n=54)
Cultigen	Maize	Y	Y	x	x	x	x	x	100%
	Squash	Y	Y	x		x	x	x	57%
	Bean	Y	Y		x				35%
Agrestal	Goosefoot	Y	Y	x	x	x	x	x	83%
	Purslane	Y	-	x	x	x		x	69%
	Beeweed	Y	Y	x	x	x		x	63%
	Amaranth	-	Y	x	x	x			53%
	Globemallow	Y	-	x		x		x	52%
	Ricegrass	Y	Y			x		x	39%
	Winged Pigweed	-	Y			x		x	35%
	Sunflower	Y	Y			x			33%
	Dropseed	Y	-			x			31%
	Saltbush	Y	Y	x		x			28%
	Buckwheat	Y	Y			x		x	28%
	Tomatillo	Y	Y	x					24%
Wild Economic	Yucca	-	Y	x	x	x		x	59%
	Pinyon	Y	Y	x	x			x	54%
	Juniper	Y	Y		x		x		52%
	Cholla/Prickly Pear	Y	Y			x	x	x	44%
	Hedgehog/Fishhook	-	-		x				26%
	Walnut	-	-				x		20%
	Manzanita	-	Y				x		19%
	Oak	-	Y				x		17%

[1]The fewest (n=5) plant assemblages are available for sites in the Puerco West settlement area, making the 50% cut-off line less meaningful.

To address patterns in plant food use at the sub-regional scale, Table 5.4 also indicates which of the common plant food taxa were present at more than 50% of sites in a particular Cibola settlement area. The most ubiquitous plant species at the regional level (i.e., goosefoot, purslane) were commonly recovered in every sub-region. The frequent presence of other food taxa however, appear to be more spatially restricted, a pattern that likely reflects both variation in local topography and microenvironments as well as differences in food production practices and food preferences across the region. For both the most commonly recovered plant foods and for taxa concentrated at smaller spatial scales, these patterns vary little through time, suggesting that the use of staple grown and gathered plant foods within settlement areas changed little throughout the periods examined in this study. In the following sections, I briefly discuss common agrestal and wild economic Cibola plant foods (see Chapter 4 concerning these divisions) and what the distribution of these food species at regional and sub-regional scales suggests about differences in cuisine across the Cibola region.

Agrestal Species and Cultivated "Weeds"

Outside of agricultural fields, it is likely that a range of ingredients and flavoring agents have long been grown or encouraged in household gardens in the Cibola area. Bohrer (1960) describes in detail the *hek:we* (waffle gardens) that were historically maintained by women on the banks of the Zuni River. In the 1950s (and today), most gardens were devoted to growing chili plants (*Capsicum* L.), and other vegetables including onions (*Allium cepa* L.) and cilantro (*Coriandrum sativum* L.). Stevenson noted in the late 19th century that both varieties of amaranth and tomatillo were also cultivated in gardens (1915: 70, 74), although it is less clear whether these were planted or simply encouraged wherever they sprouted (Bohrer 1960:182). Amaranth seeds and greens were both valued sources of food and used as a source of food-dye, especially in making the red version of *he-we* flatbread (Stevenson 1915:66). Tomatillo, further discussed in Chapter 7, is commonly found only at sites in the Central Zuni area (Table 5.4). Highly valued as a condiment, and cultivated in gardens, tomatillos appear to have a long history as an important food and flavoring agent at Zuni (Bohrer 1960; Edaakie 1999:83; Stevenson 1915).

Across the Cibola region, the most common agrestal taxa are include several species of amaranth and goosefoot, as well as purslane, beeweed, and globemallow. Buckwheat, dropseed, ricegrass, sunflower, and winged pigweed were plant foods commonly recovered only in the Upper Little Colorado and Western Puerco settlement areas in the periods examined in this study (Table 5.4). While regional patterns in the recovery of these taxa likely represent, at least in part, differences in the local abundance of certain local plant communities (i.e., grassland), I suggest they also mark differences in cuisine and localized preferences for foods with particular flavors and textures.

At Zuni Pueblo, Cushing (1920:244-245) and Stevenson (1915) both describe amaranth and goosefoot as being staple gathered and cultivated foods whose use preceded maize agriculture. In the late winter and early spring, when few fresh foods were available the greens of these annuals could have been harvested whole or the young leaves could have been repeatedly gathered (Castetter and Underhill 1935:14-15; Curtin 1984:70; Edaakie 1999:27, 31; Meals for Millions-Freedom from Hunger Foundation 1985). Ethnographic and archaeological evidence suggests that many of these agrestal species were long-standing staple pot-herbs, seasonings, and cool-season foodstuffs across much the Greater Southwest (e.g., Minnis 1989; Bohrer 1991; Huckell and Toll 2004; Moerman 2003; Whiting 1939; Yarnell 1965). Stevenson (1915:69) notes that copious amounts of beeweed were gathered to be eaten fresh or dried for winter use by Zuni families in the 1880s. Pot-herbs would have provided important vitamin (especially Vitamins A and C) and trace element contributions to diets otherwise comprised of maize.

Ethnobotanical and archaeological studies also indicate that the seeds of numerous species of grasses and members of the amaranth and sunflower families were dietary staples for prehispanic populations across the U.S. Southwest (Bohrer 1975, 1991; Doebley 1984; Stevenson 1915; Whiting 1939). Many of these agrestal species produce large quantities of small seeds in the late summer and fall, and historically these were gathered by knocking the ripe caryopses into tightly woven trays or baskets (Cushing 1920:244-246). Seeds were then often ground and mixed with cornmeal to make a variety of steamed and baked breads (Stevenson 1915:65-67). The inclusion of these ingredients into maize dishes likely provided a valued richness and diversity in terms of the flavor and texture of bread recipes, and they would have been important sources of additional nutrients (Cushing 1920; Stevenson 1915). Ricegrass, saltbush, and winged pigweed, much like amaranth and goosefoot, are included in late 19th century accounts of staple foods that preceded maize in Zuni cuisine. The importance and preparation and cooking techniques used to prepare these different small-seeded starchy plant foods likely eased the initial adoption and substitution of maize into existing cuisines in the Cibola region.

Nuts and Berries

Amongst the wild economic plants, various nuts, including pinyon, oak, and walnut would, much like sunflower, have been valued for their oily, calorie rich properties. These would be consumed as snacks or used in more processed forms as vegetable oils, oily dense breads, or as supplemental sources of oil, texture, and flavor to maize flour recipes (Cushing 1920: 243). Berries of a variety of taxa would have been highly valued for their rich range of sweet, sour, and acidic flavors. These taxa were likely consumed as seasonal snacks and used to make numerous dishes, sauces, conserves, and sweeteners (Cushing 1920: 242; Stevenson 1915: 68-70; Appendix G.1). Across the Cibola region, the most commonly recovered sources of nuts and berries are pinyon, and juniper, while the use of walnut, oak, and manzanita are more geographically restricted to settlements largely in the Silver Creek and Arizona Mountain areas.

Historically, "enormous quantities" of acorn and pinyon nuts were gathered at Zuni and used similarly to sunflower as sources of oil in food preparation (Cushing 1920:243). Pinyon nuts are highly prized, calorie-dense foods when available, although they are an unpredictable and relatively undependable local resource as periods between mast abundance span some four to seven years (Lanner 1981; Zlotin and Parmenter 2008). Juniper berries were recovered from about half of all sampled settlements, but were especially common at sites in the El Morro and Silver Creek settlement areas (Table 5.4). This is not surprising, as these are both areas of settlements in higher elevation areas. Juniper berries either consumed raw or boiled or roasted have long been important staples of cooking in the northern Southwest. Alligator juniper in particular produces especially pleasant tasting berries (Harrington 1967:243). Given their abundance on the landscape, juniper berries fresh or dried were historically collected in large quantities and processed into cakes, or used as flavoring agents in stews or similar dishes (Cushing 1920:243).

Other nut producing taxa, recovered nearly entirely from settlements in the Silver Creek and Arizona Mountain settlement areas include manzanita, oak, and walnut. As these settlements are generally located in high elevations near the White Mountains and along the Mogollon Rim, the extensive use of these species is not surprising. More interesting is the recovery of large quantities of walnut and manzanita remains at the Pueblo IV period Casa Malpais and Rattlesnake Point Pueblo sites (Brandt 1994a; Oas 2017c). The recovery of these walnut and manzanita berry remains suggests a degree of cuisine mixing occurred as more diverse groups migrated into the Upper Little Colorado in the Pueblo IV period. As these species do not grow in the area, it is likely these foods were gathered as part of long-distance gathering trips or perhaps were obtained by trade by recent migrants into the Upper Little Colorado from more southern areas.

Yucca and Cacti

Other wild species that appear to have been important food resources in the Cibola region include several species of cacti and yucca, which could easily have been propagated in areas surrounding settlements. Yucca appears commonly at sites in every settlement area in the Cibola region but the Silver Creek and Arizona Mountains areas (Table 5.4). The seeds of yucca are themselves a powerful diuretic, but the processing and cooking of yucca fruits would result in the discard of seeds (Cushing 1920:233-234; Stevenson 1915: 73). Ethnobotanical sources from across the US Southwest indicate that nearly every part of the yucca plant was used (Bell and Castetter 1941; Cushing 1920;

Ebeling 1986; Stevenson 1915; Vestal 1952; Whiting 1939). Including the use of yucca leaves and fibers as cordage for sandals, snares, cloth, basketry, bowstrings, quids, and as brushes. Yucca roots were also used for basketry, and the large taproot could be made into soap (Stevenson 1915). The flowers of yucca plants are edible, as are the immature pods that are available in the early summer and can be baked or boiled in a fashion like potatoes. The "heart" (leaf bases and root crown) of yucca plants can also be roasted like a century plant (Cushing 1920:230-233; Stevenson 1915:72-73). As one of the sweetest foods available, the mature fruits of banana yucca were eaten raw or made into a kind of prized fruit leather or compote (Cushing 1920 230-235; Stevenson 1915:72-73).

Bohrer (1986:210-214) and Fish (1984:119-12) have argued that cholla fruits were an important cool-season food resource and that cholla were likely managed or cultivated to some degree by prehispanic Hohokam agriculturalists in southern Arizona. The frequent recovery of cholla pollen from sites in the Cibola area (Brandt 1994b:541; Clary, 2000: 757; Gish, 1983, 1995) may indicate a similar use of cholla fruits and a degree of local management. Cushing (1920:237) describes the use of at least two species of cholla fruits, which were valued for their sweetness and because they were less spiny than other types of cactus fruits. Prickly pear fruits would have been another food resource that would have been more resilient to drier seasons, although their harvest and the removal of spines would have necessitated the use of special tools or techniques (Cushing 1920:237-238). In addition to being consumed raw, once the spines were removed, prickly pear fruits were also historically dried and ground into a flour that was added to cornmeal (Stevenson 1915:69). Hedgehog or fishhook cacti are more associated El Morro Valley settlements than any other area of the Cibola region (Table 5.4).

Hedgehog cactus has a highly flavorful fruit, and like the fruits of the other species described above, would have been some of the sweetest and perhaps prized foods available to prehispanic populations in the Cibola region.

Summary

The preceding comparison of plant food assemblages across the Cibola region highlights the importance of maize as the staple plant food for all periods examined here. In addition to growing maize, beans, and squash and raising domesticated turkeys, farmers and families across the Cibola regional also consistently hunted, encouraged, and gathered a diverse range of animals and plant food species A.D. 900-1400. In terms of differences in cuisine and the use of local signature ingredients, settlements located in the southwestern Silver Creek and Arizona Mountain areas along the Mogollon Rim appear the most distinct, gathering calorie rich foods from species of manzanita, oak, and walnut. While the remains of plant foods recovered from sites in the Central Zuni and El Morro Valley are similar, Central Zuni sites are more associated with the use of tomatillo while sites in the El Morro Valley more often indicate the use of juniper and hedgehog cactus. More western areas, the Puerco West and Upper Little Colorado, are characterized by a pronounced use of winged pigweed and several species of grasses.

Despite some differences in the use of signature plant foods at the sub-regional scale, the overall temporal stability of plant food use in the Cibola region is consistent with dietary analyses of coprolites in the Four Corners area (e.g. Minnis 1989) and archaeobotanical evidence of wild and cultivated plant use from other regions Greater Southwest (e.g. Fish 2004; Gasser 1982; Huckell and Toll 2004). Together these studies highlight the enduring success of food production strategies involving a mixture of farming, cultivation, and foraging of plant and animal foods through periods of climatic instability and, in terms of this study, rapid changes in settlement size and population density.

Aggregation, Nucleation, and the Scale of Food Production

In the Cibola region, maize was uncontestably the staple food by A.D. 1150, and it is unlikely that the overall subsistence economy at Zuni shifted significantly until after the introduction of U.S. government agricultural policies in the mid-19th century (Cleveland et al. 1995). In the 13th and 14th centuries, however, it is likely that the social transformations documented across the Cibola region involved important changes the political economy and the intensity of food production practices (Potter 2000; Saitta and Keens 1990; Spielmann 2002; Chapter 3).

In the following sections, I draw on botanical and faunal data to examine how Cibola households and communities in the Pueblo III and IV periods intensified plant and animal food production in relation to broader changes in settlement size and social organization. While households were likely the basic units of daily food production and consumption activities in these periods, I suggest that clans and other supra-household social groups were increasingly involved in determining access to and the distribution of agricultural land and other food resources in aggregated villages and nucleated towns (Adler 1996b; Potter 1997a, 2000; Saitta 1994). Overall, while subsistence strategies changed little through the periods examined here, this study addresses how changes in the demographic scale and social organization of aggregating communities interacted with cuisine and how food different foods were produced, stored, prepared, and consumed in daily meals and supra-household commensal events (Chapters 6-8).

Agricultural Intensification

Across the Cibola region, several lines of botanical evidence suggest that a degree of agricultural intensification accompanied the establishment of aggregated villages and especially large nucleated pueblos in the late 13th century (Fig. 5.2). While maize ubiquities in earlier periods are highly variable between individual sites, maize is found in virtually[3] every sample recovered from Pueblo IV period nucleated towns across the Cibola region. As variation is more likely to go up rather than down as sample size decreases, it is notable that the opposite pattern in maize ubiquity is observed (Table 5.5).

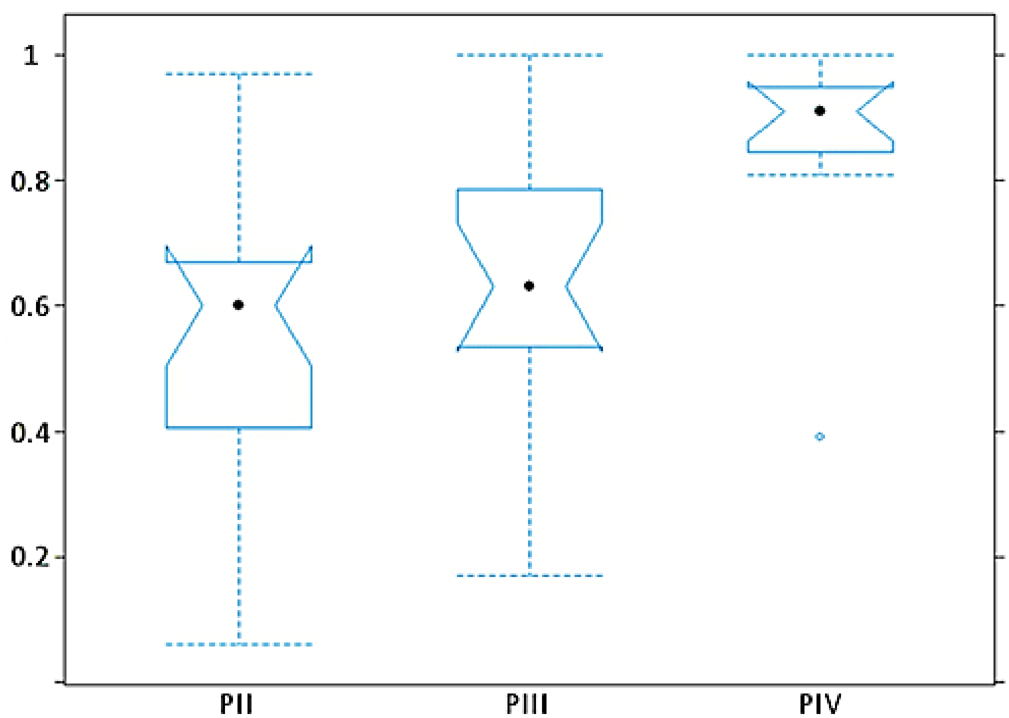

Figure 5.2. Ubiquity of Maize across the Cibola Region A.D. 900-1400.

It has previously been noted that recovery rates of maize are highly variable in time and space across the Greater Southwest (Fish 2004, Table 4.2; Hard et al. 1996). The results of this study, however, suggest that thorough regional-scale comparisons of maize ubiquity from numerous sites and well-dated samples can provide meaningful insights into shifting food production practices through time. Furthermore, despite well-known issues of underrepresentation in the macrobotanical record (Gasser and Adams 1981:183-184; Chapter 4), similar trends can also be seen in the increasing ubiquity of two other important domesticated plants, beans and squash (Fig. 5.3; Table 5.5).

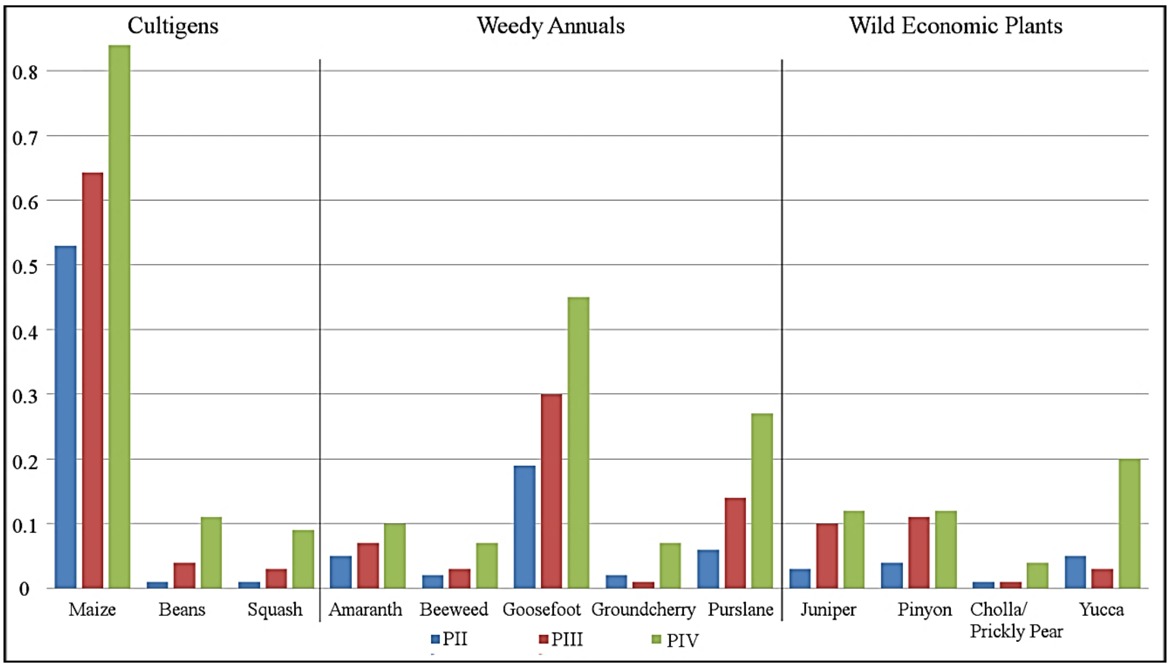

Figure 5.3. Ubiquity Measures of Cultigens, Weedy Annuals, and Wild Economic Plants.

The ubiquities of weedy annual species that thrive in disturbed environments are expected to increase in conjunction with the establishment of larger, denser settlements and increasing agricultural expansion. Anthropogenic agricultural landscapes provide a perfect habitat for weedy disturbance-loving species, and these plants were likely encouraged as a convenient supplemental food source. This is especially the case when agricultural intensification involves the extension of cultivated field and garden areas and the expansion of water and soil control infrastructure (e.g., irrigation ditches, check-dams). As such, it is significant that similar trends in the increasing ubiquity of domesticated crop and a wide range of agrestal species like amaranth and purslane are observed across the Cibola region (Table 5.5).

Increases in the ubiquity of some perennial wild food plants can also be observed (Fig. 5.3, Table 5.5). As many settlements in the Pueblo III and early Pueblo IV periods were located in higher elevation areas well-suited for dryland agricultural strategies, it is likely this would have made it increasingly easy to access a mixture of pinyon and juniper fuel, timber, nuts, and berry resources. Increases in the ubiquities of several species including cholla, yucca, and prickly pear may suggest that communities of these plants were also being encouraged to grow around large nucleated settlements in the late 13th and early 14th centuries (Fig. 5.3).

Table 5.5: Taxonomic Identification and Ubiquity of Cibola Plant Foods (n=number of flotation samples)

Taxon	**Common Name**	**PII (n=776)**	**PIII (n=337)**	**PIV (n=276)**
Zea mays	Maize	53%	64%	84%
Phaseolus sp.	Beans	1%	4%	11%
Cucurbita sp.	Squash	1%	3%	9%
Amaranthus sp.	Amaranth	5%	7%	10%
Cleome sp.	Beeweed	2%	3%	7%
Chenopodium sp.	Goosefoot	19%	30%	45%
Physalis sp.	Groundcherry	2%	1%	7%
Portulaca sp.	Purslane	6%	14%	27%
Juniperus sp.	Juniper	3%	10%	12%
Pinus edulis	Piñon	4%	11%	12%
(Platy)opuntia	Cholla/Prickly Pear	1%	1%	4%
Yucca sp.	Yucca	5%	3%	20%

While these cactus species are all prized for their sweet fruits, yucca was also an especially important source of fiber historically and is particularly associated with Zuni textile production (Stevenson 1915: 78; Webster 1997:82-103). As the high elevation and restricted growing season of the modern Zuni reservation makes it very difficult to grow cotton (Bohrer 1960:198), the more than fourfold increase in yucca ubiquity in the Pueblo

IV period may also reflect an increase in in the scale of fiber production in the Pueblo IV period. If so, this pattern parallels the intensification of cotton production documented in other portions of the northern Southwest in this period (e.g., Adams 1991, 2002).

Meat Production and Procurement

In this study, I suggest that changes in communal ideologies and the scale of participation in ritual commensal events contributed to regional increases in artiodactyl meat procurement (Fig. 5.4) and turkey production (Fig. 5.5). In the Cibola region, previous faunal surveys suggests that the scales at which large-bodied game, mainly deer and antelope, were being procured remained stable or increased in the late 13th century (Schollmeyer and Driver 2013). This contrasts with other portions of the northern U.S. Southwest, where populations of large game were depressed in earlier periods (Badenhorst and Driver 2009; Driver 2002; Schollmeyer and Driver 2013).

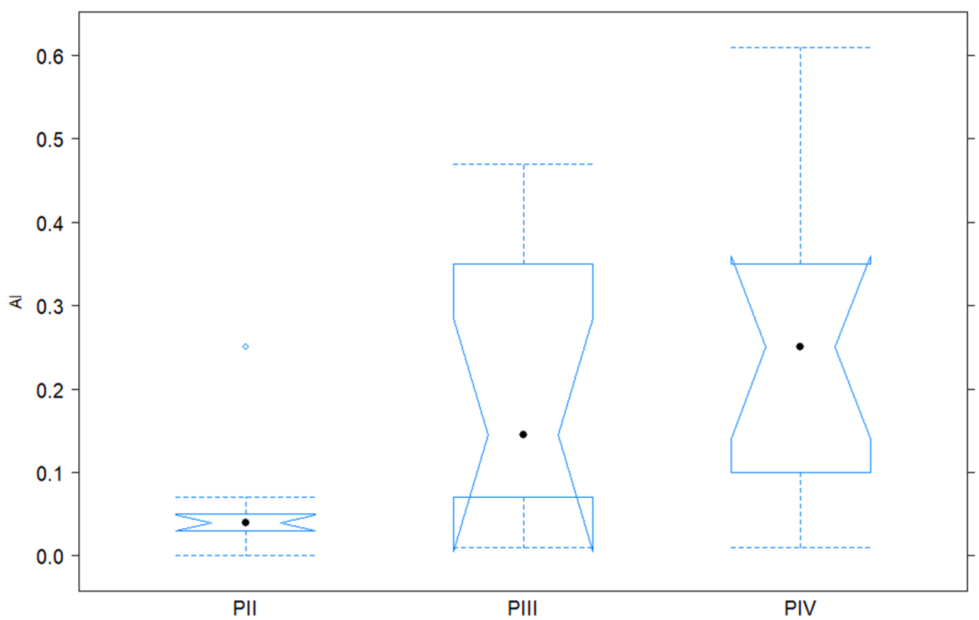

Figure 5.4. Cibola Artiodactyl Index Values A.D. 900-1400.

Differences in settlement history, population circulation, and access to high-elevation areas in the Cibola region (i.e., Zuni and White Mountains) are thought to have contributed to sustained levels of artiodactyl procurement in the Pueblo III and IV periods (Fig. 5.4; Schollmeyer and Driver 2013). Furthermore, intra-site scale analyses suggest that increases in the procurement of both deer and the communal hunting of more distant pronghorn species often were linked to communal feasting activities in the plazas of 14th century towns (Potter 1997a, 2000; Dean 2001; Zack-Horner 1999). Overall, while Pueblo III and IV period artiodactyl index values are quite variable (Fig. 5.4), there is a clear increase in the relative abundance of artiodactyls following population aggregation and nucleation into large towns in the late 13th and early 14th centuries.

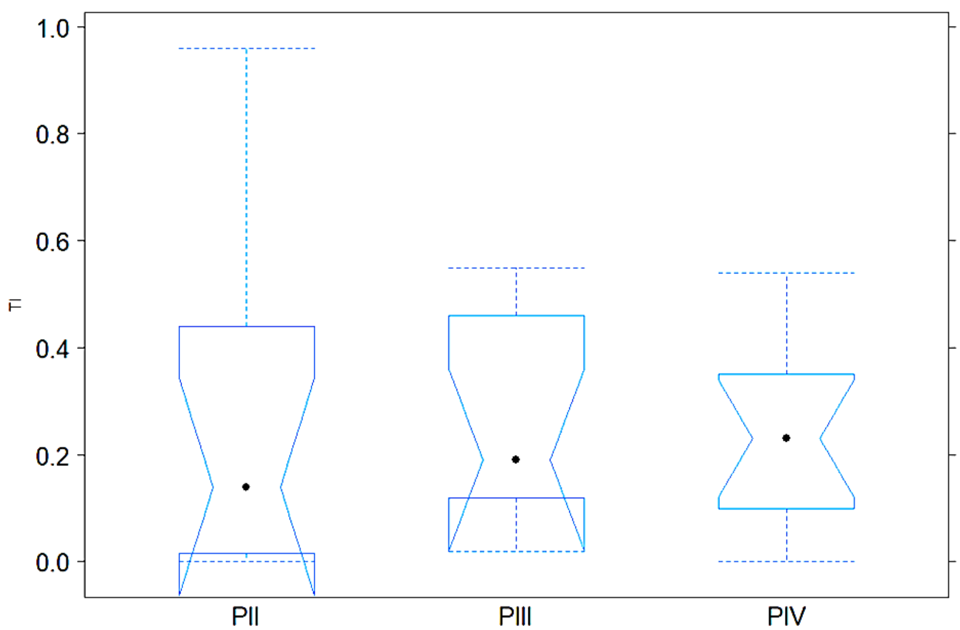

Figure 5.5. Cibola Turkey Index Values A.D. 900-1400.

Standardized turkey indices have been used to compare different regional trajectories of turkey domestication and production intensification over time across the northern U.S. Southwest. Intensifications in turkey production, particularly of those documented across the Northern San Juan region, have usually been interpreted as a response to the decreased availability of large-bodied game and a need for alternative sources of dietary protein in the Pueblo III period (e.g., Driver 2002; Badenhorst and Driver 2009; Spielmann and Angstadt-Leto 1996).

In the Cibola region, Potter (2000) has argued that increases in turkey production were linked to their consumption at communal feasts in the El Morro Valley. Turkeys, especially captive, domesticated turkeys, would have been attractive as more predictable sources of meat. Figure 5.5 shows turkey index values across the Cibola region. Turkey index values are variable in each period, but especially across samples from small Pueblo II period sites. It is important to note that the highest Pueblo II period turkey index value was not inflated by the presence of articulated turkey internments (Appendix C.1). The range of turkey index values for Pueblo II period sites suggests that turkeys were food of longstanding importance across the Cibola region prior to population aggregation, although the use and investment in the production of turkeys varied greatly from site to site.

Altogether, increases in both artiodactyl and turkey index values provide an interesting contrast with patterns of artiodactyl and turkey use from other portions of the northern Southwest. As noted above, Potter (2000) has argued that the simultaneous increase in the production and procurement of artiodactyls *and* turkeys at Pueblo de los Muertos and settlements in the El Morro Valley were tied to the hosting of integrative communal feasts in plazas. While raising large herds of turkey may have been desirable in terms of providing readily available and abundant meat for communal feasts, keeping larger flocks of domesticated turkeys would have been extremely costly in terms of labor and the maize needed to feed them. It is likely that increases in the ubiquity of maize observed across the Cibola region were linked to some degree to increases in the scale of domesticated turkey production in the late 13th century.

Chapter Summary

Patterns in the use of cultivated and gathered signature plants and flavoring agents suggest some persistent differences in cuisine across settlement areas in Cibola region. Settlements in the Upper Little Colorado provide the strongest evidence for the mixing and adoption of new foods over the Pueblo III and IV periods, a process that may have involved the incorporation of migrant groups. The production of staple cultivated plants and animals varied little across the Cibola region following aggregation and settlement nucleation. However, consistent increases in the ubiquity of maize as well as a range of other cultigens and pioneering agrestal taxa suggest that the *scales* of food production increased dramatically following the formation of aggregated villages and again with the establishment of large nucleated pueblos. Increases in the intensity of maize agriculture are associated with a significant shift in maize cob row-number. This change in the varieties of maize being grown likely reflects a greater focus on flour types of maize and an increasing focus on fine flours and maize breads in Cibola cuisines; this is further taken up in Chapter 6. Agricultural intensification not only fed groups living in large villages and dense towns, but also allowed larger flocks of domesticated turkeys to be raised. Evidence for the increased production of turkeys and artiodactyls across the Cibola region suggests that individuals and families in many settlements may have invested a great deal in financing and participating in an assortment of rituals events and supra-household meals.

Chapter 5 Notes

[1] In the Central Zuni area, cotton was recovered only as traces of pollen in the Pueblo III and IV periods at Hinkson Ranch (Schoenwetter 1992) and *Halon:awa* North (Smith 2003) respectively. Bohrer (1960:198) note that historically cotton was grown with great difficulty in waffle gardens at Zuni Pueblo:

> "Native cotton (*Gossypium hopi*) Lewton was grown in Zuni as late as the 1880's. In 1916 Spier speculated on the probability that it was still grown then. According to his description, it was planted in holes about one and a half inches deep and covered with white sand. This was apparently done within the waffle gardens and received hand-watering every three days. The cotton was planted in July and was ripe in September. The bolls were picked, broken open, sand and seeds removed by hand, and the fibers straightened with fingers and the snarls and imperfect fibers removed."

Recovery of seeds, pollen, lint, and bolls from Pueblo II-IV period sites in the Western Puerco, Silver Creek, and Arizona Mountain areas suggest that a degree of local cotton cultivation was practiced in these areas (Anyon et al. 1983; Bohrer 1973; Fish 2004; Longacre et al. 1982; Mills et al. 1999).

[2] Cattail was also a commonly (31%) recovered food resource. It is not included in Table 5.4 as cattail was recovered almost exclusively as pollen, and inconsistencies with respect to pollen sampling and analysis prevent a comparison of cattail use between sites and settlement areas. The 31% recovery rate likely underestimates the importance of this calorie dense and protein rich riparian food resource in the Cibola region.

[3] The one Pueblo IV period outlier with a low maize ubiquity is an unusually small site that more closely resembles earlier Pueblo III period settlements (Raily 2008).

Chapter 6:

HOW THE ROOFS GROAN; CIBOLA FOOD STORAGE AND PREPARATION

"How the roofs groan under the weight of drying corn; how the walls gleam and glory with festoons of chile (Cushing 1920:212)."

In this chapter I turn to food activities that often occurred within (or on top) of houses and examine changes in the organization and scale of food storage and preparation activities in the Cibola region through time. The labor, time, and techniques used to process and prepare foods are guided by how, how much, and when certain foodstuffs need to be cooked, consumed, or stored. In the previous chapter a mixture of archaeological plant and animal evidence indicate that as large villages and plaza-oriented towns were established both the scale of social life and scales of food production increased. Increases in food production involved growing more flour varieties of maize, and in some areas hunting more artiodactyls and keeping of larger herds of maize-fed turkeys to provision communal feasting events.

Cross-culturally, hosting or otherwise financing feasts requires extensive planning in terms of food storage and preparation (Smith 2015). What then did changes in cuisine and commensality in the late 13th and early 14th centuries mean for Cibola households and the labor and status of those preparing food? One way to understand the implications of changing cuisines and scales of food preparation in terms of the daily lives of people (especially women) in the Cibola region is to examine changes in food storage and preparation activities, especially those surrounding the preparation of staple foods. In this chapter, I draw on a combination of ethnography, experimental archaeology, and architectural, groundstone, and ceramic data to explore regional patterns in food processing and storing practices and examine trajectories in the intensity and organization of maize preparation activities across the Cibola region.

Food Processing and Storage

Food processing or post-harvest activities encapsulate a broad range of tasks associated with preparing foods for both immediate consumption or for transport or longer-term storage. While fresh foods like green corn and seasonably available fruits would have been celebrated, processed foods were also highly valuable, though perhaps sometimes less for their taste than for their utility as travel foods or as foods consumed in the in the lean times of the year. Without access to modern refrigerator technology much of a household's time and labor, especially in the harvest season, was committed to processing foods to preserve them for the coming year. Processing and storage activities are fundamentally connected, as much of what is processed is intended for future use. For households in the Cibola region processing activities, likely often the work of women, would have regularly involved threshing, peeling, drying, masticating, soaking, boiling, washing, grinding, toasting, and mixing together different plant and animal ingredients to produce daily meals and to store for future use (Cushing 1920; Edaakie 1999; Stevenson 1904, 1915). I discuss the work of grinding maize in greater detail in the following section on food preparation.

Food stores themselves are important arenas of social interaction and exchange. If we are to understand the political and socioeconomic significance of increases in the scales of food production, we need to consider where, how, and by whom these foods were redistributed, stored, and consumed. As discussed in Chapter 2, changes in the scale or organization of storage practices may indicate shifts in the social dynamics of groups and/or the political economy (e.g. Hastorf 2016:209-210; Morehart and De Lucia 2015; Saitta and Keene 1990; Saitta 1994). Whether storage spaces are visible or invisible to supra-household groups has social and political ramifications (Hastorf and Fox 2015; Hendon 2000) especially when egalitarianism is emphasized (Twiss and Bogaard 2017).

Ethnographic Accounts of Food Processing and Storage at Zuni

At Zuni Pueblo, women historically had an important role processing food for storage and in selecting the seeds of maize and other plants to grow in the following year (Cushing 1920:172). The primary harvest season (mid-September through early October) would have been associated with the highest volume of food processing activities. Most tasks would have involved rendering harvested and seasonally gathered ingredients into usable (and storable) forms for the upcoming winter. Freshly roasted green maize was either directly consumed or hung up to dry inside homes (Cushing 1920:208). Maize not processed in the fields was husked in the village by "husking bees" of women who generated, "mountains of cast-away shucks" (Cushing 1920: 211). These husks were used in a great variety of recipes and stored in large ceramic jars or stone-slabbed bins (Stevenson 1904:353). Harvested beans were threshed (Cushing 1920:189), and squashes were often sliced into long strips and hung to dry (Stevenson 1904:353-354). Maize, squashes, peaches, chiles and other harvested foods were laid out on the rooftops to dry and then further sorted for storage (Cushing 1920:212; Stevenson 1904:352).

Once dried, harvested maize would be sorted by color and by the grade of the ears (i.e., if the ears were full or underdeveloped). Cobs were then moved into dedicated store rooms and stacked into rows that were spaced to allow adequate airflow and reduce chances of moisture buildup, spoilage, and spontaneous combustion. The best ears of each maize variety were set aside, and sometimes specially processed and stored in skin bags for next year's planting (Cushing 1920:172-173). Processing special seed corn involved shelling the kernels and mixing them with corn smut (*Ustilago maydis*) and pollen, salt from the Zuni Salt Lake, and flowers of *ayaho* or tansy mustard which, as plants that blooms in the early spring, would encourage the corn to mature more quickly (Bohrer 1960:187; Cushing 1920:172-173). Zuni storerooms also contained special corn guardians (Cushing 1920:167-168; see also Bohrer 1995). These consisted of a full or perfect ear of maize dipped in the Zuni Salt Lake, a nodule of corn smut, and two special cobs, the corn "father" (a full ear of yellow maize) and "mother" (a bifurcated ear of white maize) bound together with cotton thread.

Overall, foods intended for longer-term storage, such as those saved for use as seed stock or intended for winter consumption, were kept in dedicated storerooms or granaries that offered protection from moisture, rodent and/or human enemies who might damage or steal food stores. Across the U.S. Southwest, historical accounts suggest that households typically stored one to three years' worth of maize (e.g., Stevenson 1904: 353; Whiting 1939:15), a practice that persisted at Zuni Pueblo at least into the 1950s (Bohrer 1960:182). For ingredients or foods intended for more immediate use, a range of other ceramic, animal skin, or basketry storage implements was also used. Foods historically stored in ceramic containers at Zuni include late squash and pumpkin flowers (Cushing 1920:208), long dried strips of squash (Bohrer et al. 1960:196) and *he-we* bread, "partially doubled or folded into masses…packed away in permanent half-buried jars provided with close-fitting lids (Cushing 1920:338)." Rolls of processed yucca fruit were also preserved in large sealed jars or hidden in wall niches (Stevenson 1915:72).

Semi-processed parched seeds and nuts are recorded as being kept in bags colored to signal their contents (Cushing 1920:251), and maize flour which was prone to spoilage and attracting pests was also kept in bags (1920:391-392).

Archaeological Evidence of Food Storage

In the U.S. Southwest, archaeologists frequently assign different functions to rooms in masonry roomblocks. Storerooms are typically identified based on comparatively smaller room dimensions and the lack of formal domestic features like hearths, and sometimes the presence of cobble or other floors. Dean Saitta (1991) compared frequencies of different types of architectural spaces (i.e., habitation, storage, kiva) to address how changes in the size and political complexity of groups at the Pettit site in the El Morro Valley interacted with the political economy and scales of communal surplus labor. Saitta and Keene (1990) argued that the relatively high ratio of storage space to habitation space at the Pettit site was, "motivated to fill communal social rather than biological needs," including the need to finance more complex political institutions (1990:221-222). Limited comparable data exist, making it difficult to examine this pattern at larger spatial or temporal scales in the Cibola region.

Generally, few archaeological studies have sought to systematically examine or compare the nature and organization of storage activities. Exceptions include work by Richard Ciolek-Torrello (1985) and Tiffany Clark (1998) who both examined artifactual patterns to understand the uses associated with "storerooms". The rooms and archaeological deposits examined in these studies were thought to represent primary or *de facto* deposits, making them likely more accurate reflections of seasonal household storage activities prior to site abandonment. Both studies suggest that storerooms were not areas where other food processing, preparing, or cooking activities often occurred, and that storerooms in Pueblo IV period settlements might have been used to store domestic and ritual items for household or supra-household groups.

Several paleoethnobotanical studies of *de facto* plant assemblages provide additional insights into food storage practices across the Cibola region. In the Arizona Mountains area, Vorsila Bohrer documented the use of pine needles as matting for storing corn, beans, and walnuts (Bohrer 1973:426). In a similar fashion, woven mats of reeds (*Phragmites* sp.) and yucca cordage were used to contain and store large quantities of beans and stacked rows of maize cobs at Rattlesnake Point Pueblo the Upper Little Colorado area (Oas 2017c). In the north, Miksicek's (n.d.) study of plant remains in the El Morro Valley found significant differences in the cob row numbers and kernel cupule widths of different piles of maize cobs stacked on the floors, and more generally between floor and roof samples of maize in storerooms at the Scribe S site. The storerooms at Scribe S may reflect both the drying of a harvest on the roof and the storage of different maize varieties selected for future planting in the rooms below. NA 11,527, a Pueblo III period site in the Central Zuni area, provides an additional example of a burned storeroom filled with stacked maize cobs still in their husks on the floor.

In addition to masonry storage rooms and rooftop or rafter spaces, a wide range of intramural and extramural slab or adobe-lined bins, cists, and bell-shaped pit storage features have been recorded and excavated at sites across the Cibola region. As might be expected, these are associated with an enormous diversity of botanical remains, including the full range of frequently recovered signature plant foods and flavoring agents discussed in Chapter 5 (Oas 2017a). While rare, several ceramic jars containing seeds and other plant parts have been recovered from Pueblo III and IV period sites in the Cibola region, providing direct evidence for the use of storage jars to keep seeds or other parts of different plant foods for future planting or use in preparing meals. In southern Cibola settlements plant food taxa recovered from storage jars include cotton seeds, cholla buds, immature prickly pear stems, large quantities of walnuts stored in corrugated vessels, juniper berries, manzanita berries, pinyon nuts, yucca fruits, goosefoot/amaranth seeds, sumac berries, and winged pigweed seeds (Bohrer 1973; Dosh 1988; Mills et al. 1999; Oas 2017c). In the north, jars have been recovered containing maize kernels, squash seeds, beans, and goosefoot seeds (Burton 1990). One corrugated jar recovered from the Scribe S site contained kernels of likely the *Reventador* flint or popcorn type inside (Miksicek n.d.).

Decorated Storage Jars

As decorated jars may have often been used primarily for short-to-long term storage of dried foods or liquids, body sherds of decorated jars were examined to evaluate changes in the scales of food storage across the Cibola region over time (Table 6.1). Decorated white and red ware jars have similar volumes, and differences in the mean volume of decorated jars vary relatively little from site to site across the Cibola region or over time (Table 6.1; Fig 6.1). Across settlement areas and periods, mean decorated jar volumes in the Central Zuni and Upper Little Colorado areas fall in a 12-16-liter range (Table 6.1). Decorated jars from settlements in the El Morro Valley however, have slightly higher mean volumes. While little comparable data for decorated jar volumes is available, jars from the Pueblo III period Sand Canyon Pueblo in the Mesa Verde region have similar mean volume measures for uncorrugated "medium" (11-13 liter) and "large" (18-19 liter) jar groups (Ortman 2000, Table 14).

Table 6.1. Statistical Summary of Decorated Jar Volumes.

Period	Sub-Region	Site	Sample (n)	Mean Volume (l)	SD	CV
PIII	CEN	NA 11,527	37	13.3	5.7	0.43
PIII	CEN	NA 11,530	38	15.4	8.2	0.53
PIII	CEN	Jaralosa	24	16.5	7.1	0.43
PIII	CEN	Hinkson	123	16.8	7	0.42
PIV	CEN	Heshot uła	32	10.8	4.8	0.44
PIV	CEN	Lower Pescado	58	14.7	6.2	0.43
PIII	EMV	Los Gigantes	59	16.5	7	0.42
PIII	EMV	Tinaja	50	16.6	8.4	0.51
PIII	EMV	Pettit	56	16.9	10.2	0.17
PIII	EMV	LA 132353	17	18.4	8.2	0.44
PIII	EMV	Scribe S	59	20.6	13.8	0.67
PIV	EMV	Atsinna	43	14.5	7.6	0.53
PIV	EMV	Mirabal	106	17.5	12.4	0.71
PIV	EMV	Pueblo de los Muertos	175	18	11.5	0.64
PIII	ULC	Rim Valley	40	13.3	13.3	0.48
PIII	ULC	Coyote Creek	138	13.7	8.1	0.59
PIII	ULC	Rudd Creek	65	15.5	9.1	0.59
PIV	ULC	Baca	34	12.7	6	0.47
PIV	ULC	Hooper Ranch	111	12.8	5.9	0.46
PIV	ULC	Table Rock	135	13.5	6.1	0.45
PIV	ULC	Casa Malpais	89	14.4	5.2	0.36
PIV	ULC	Rattlesnake	105	16	8.7	0.54

If decorated jars, particularly white wares, were primarily used to gather and store water as ethnographic and archaeological studies suggest (Chamberlin 2002; Cushing 1920; Stevenson 1904), collecting water for cooking, drinking, and cleaning activities would have involved multiple daily trips carrying jars likely weighing somewhere between 20-40 pounds when full. Given the physical difficulty in handling and carrying jars of larger sizes, it is possible that jars that could hold more than 20 liters (i.e., 44 pounds of water) were containers used as permanent fixtures in storerooms. Households in the El Morro Valley produced and used relatively more large (>20 liter) and very large (> 30 liters) decorated jars in the Pueblo III and IV periods (Fig. 6.1), although it is not clear how to interpret this finding.

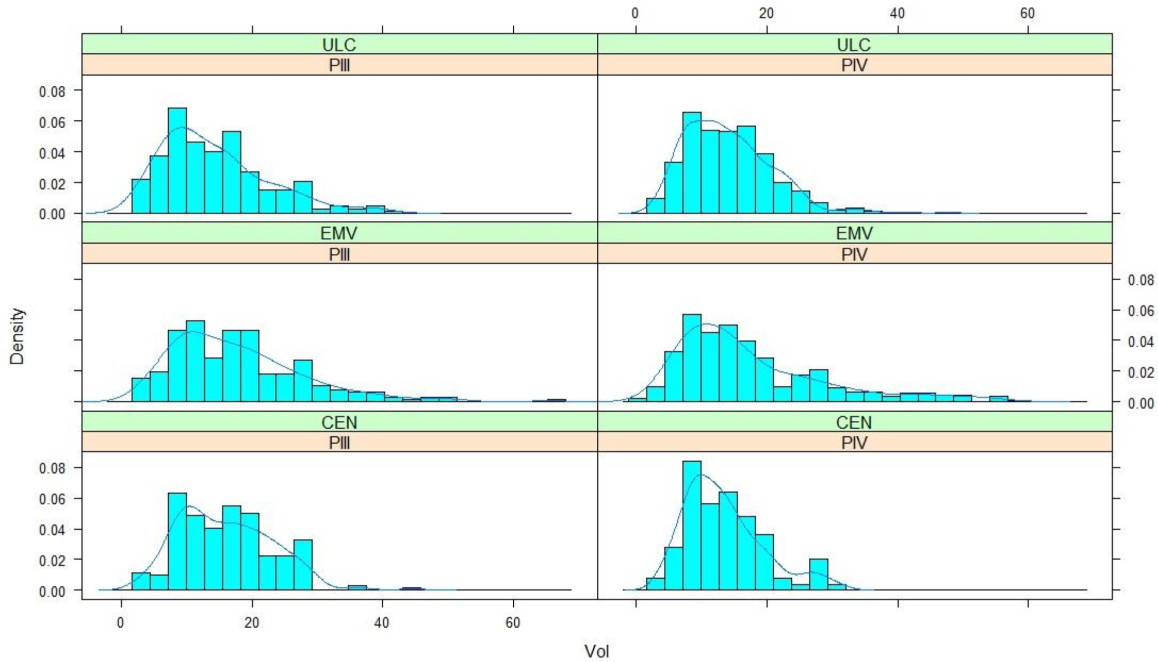

Figure 6.1. Kernel Density Estimates and Histograms of Cibola Decorated Jar Volumes (l)

Summary

Across the Cibola region, households practiced similar food processing and storage practices, making use of dedicated storerooms, rooftops, subterranean features, and ceramic vessels to keep stacks of maize cobs and a range of other plant ingredients. Following settlement aggregation it is possible that more architectural area was devoted to storing foods intended for both household and supra-household consumption at least at some settlements (Saitta 1991, 1994). There is, however, little indication of significant changes in the size of ceramic storage vessels or in the overall spatial organization of food storage practices in the Cibola region over the 13th and 14th centuries. While settlements in the El Morro Valley may have used larger decorated ceramic jars more regularly, at the regional scale food storage appears to have been consistently managed at the household level as there is little evidence to suggest public and/or communal food storage features were used in the periods examined here. This contrasts with evidence from Sand Canyon Pueblo in the Mesa Verde region (Potter and Ortman 2004:181) and Schoolhouse Point Mesa in the Tonto Basin (Lindauer 2000) where population aggregation is associated with more centralized food storage in addition to integrative communal food preparation and feasting activities.

Food Preparation

The processes of transforming various ingredients into foods have both nutritional (e.g., Wollstonecroft 2011) and powerful symbolic significance (e.g., Haaland 2007). Preparing ingredients renders them suitable to eat (in the sense of cuisine); it also may also improve the digestibility of foods and increase the bioaccessbility and bioavailability of certain nutrients. Cross-culturally, highly processed and laboriously prepared foods often hold special symbolic importance and take pride of place in the sharing and exchange of foods at daily meals and communal feasts (e.g., Adapon 2008; Hastorf 2016:84; Logan and Cruz 2014). In the U.S. Southwest, maize flatbreads like Hopi *piki* and Zuni *he-we*, are esteemed as their creation involves the skilled execution of complex recipes and hours of work involving soaking, parching, grinding, mixing, applying and collecting applications of very finely ground maize batter over special heated griddles (Allen 1995; Cushing 1920; Dedecker 2005; Stevenson 1904). As such, examining trajectories in the techniques, scale, and organization of food preparation activities is essential for understanding changes in diet and cuisine, and what these changes may have meant in terms of the labor, status, and identity of those doing the preparation work.

Ethnographic Accounts of Food Preparation at Zuni

Food processing activities, particularly grinding maize into flour, were central daily tasks for Zuni women historically and considered a central feature of the “arts of women" (Cushing 1920:306-309; Stevenson 1904:165). A range of ethnographic estimates provide some insight into how much time and labor might have been directed to grinding maize to make breads and other foods in the Cibola region in prehispanic and historic periods (Table 6.2). Each of these ethnographic examples represents a cuisine where processing cereals into fine flours to make staple breads (i.e., *tortillas*, *piki*, *injera*) involved, at least historically, three to five or more hours *daily* grinding cereals to make bread. These ethnographic estimates generally do not include the additional time spent cleaning, maintaining, or manufacturing groundstone tools (see Nixon-Darcus and D'Andrea 2017), and also rarely indicate potential differences in the work needed to grind foods for daily consumption versus the number of hours that might be spent preparing mass quantities of food for special events. If the late summer and early fall were historically the most intense periods for processing foods for storage at Zuni, then the *Sha*'*lak*'*o* feasts hosted in early December and the many dances hosted in mid-summer made those the busiest seasons for women preparing food at Zuni historically and today (L. Walela, personal communication, August 22, 2018).

At Zuni, ethnographic accounts suggest that grinding maize flour for daily meals or at *oknak'yanna* (special corn grinding ceremonies for feasts) could be both an individual and group activity (Allen 1995; Cushing 1920; Stevenson 1904). Producing enough fine flour for feasting foods often involved "milling bees" that at times extended late into the night (Cushing 1920: 286, 387-390). For more well-off families and those with special ceremonial obligations this might involve gathering groups of up to 16 women who worked at as many as eight mealing bins in rotations (Stevenson 1904:238-239). Younger women, "warmed and perspiring from the violent exercise at the metate"

(Cushing 1920:196), would be accompanied by older women who at various stages of the process would toast kernels or meal over the fire and supply these to the women grinding (Stevenson 1904:239). “The one on the right quickly crushed a quantity of the toasted kernels… passed the coarse meal to the next, who reduced it still more, until growing finer under each successive stone, it came out at the other end fine as pollen (Cushing 1920: 387).”

Table 6.2. Select Ethnographic Estimates for Daily and Weekly Hours Spent Grinding.

Region/Group	Average daily hours grinding	Hours per week	Reference
Maya	4-5	28-35	Hayden and Cannon 1984:68
Central Mexico	6-8	42-56	Brumfiel 1991:238
Hopi	3-5	21-35	Bartlett 1933:28; Dorsey 1899:741
Tigrayan (northern Ethiopia)	3	21	Nixon-Darcus and D'Andrea 2017: 217, Table 10

Cushing suggested that the bodily fatigue and tedium of grinding for an entire day was mitigated somewhat by the comradery of working with others, and by the musical accompaniments and dancing that often were provided for those preparing food for ceremonial meals (Cushing 1920:389; Stevenson 1904:228-229, 238-239). Women helping clan members grind huge quantities of meal for these events might also be treated to a feast presented by the host family and given large bowls of stew and baskets of bread to take home (Stevenson 1904:240, 592, Plate XXXXII).

Table 6.3. Zuni Names for Types of Maize Flour Processed into Differing Degrees of Fineness.

Zuni Name	Description	Reference
Sak’o:we	Meal coarsely ground	Cushing 1920:294
Dow owe	Maize grain reduced to meal (medium fine)	Allen 1995: 31; Cushing 1920:294
O’-lu-tsi-na	Maize grain ground to exceedingly fine flour	Cushing 1920:294
Chumo’ts’ikkwahna:we	Hominy, grains skinned by boiling in ash water and carefully ground	Allen 1995: 31; Cushing 1920:293-294

Zuni women historically made a variety of mushes, dumplings, cakes, and breads daily using maize flour processed to different levels of fineness (Table 6.3) and a range of different preparation techniques and supplementary ingredients (Appendix G.2). Beyond grinding maize, other important food processing and preparation steps at Zuni include parching kernels and soaking or treating maize kernels with *a:luwe* (wood ash and/or lime solutions) (Edaakie 1999:8; Cushing 1920:294). Fermenting ingredients through mastication, where the amylase enzyme in human saliva converts starches to sugars, was also a common step in making a variety of breads and cakes (Cushing 1920:300-301,340-341, 557; Edaakie 1999:45), and processing banana yucca fruits into highly prized rolls of fruit paste or conserve (Cushing 1920:234-235; Stevenson 1904:368).

The Daily Grind: Cibola Mano and Metate Manufacture and Use

To understand how cuisine and scales of food preparation may have varied across the Cibola region following population aggregation, in this section I examine changes daily food preparation through analyses of the manufacture and use of mano (*yalinne*) and metate (*ak'e*) sets. The types of metates manufactured and used at settlements provide information about the types of materials that the users intended to process using them. In some cases, the design of metates can also indicate differences in technological traditions of metate manufacture. The size of grinding sets can be used to evaluate the scale or intensity of food preparation activities. Finally, patterns of mano maintenance and use can be examined to understand different grinding techniques and the daily strategies employed by grinders in: (1) using tools longer (more efficiently); or, (2) using tools more intensely (longer grinding sessions).

Material Choice and Tool Size

The majority of recorded metates (78%) were manufactured from sandstone. Given inconsistencies in the collection and recording of metates and metate fragments in the Cibola region in the past, it is not easy to confidently assess trends in metate material use. El Morro Valley and Central Zuni sites generally have higher percentages of vesicular basalt metates[1], while sites in the Upper Little Colorado more often favored sandstone or other stone types (e.g., rhyolite, limestone). No northern sites had assemblages with metates not made from "other" materials. Patterns in manos material are similar; most (83%) were manufactured from sandstone materials. As with the metates, the majority (82%) of manos manufactured from materials other than sandstone or vesicular basalt were from the Upper Little Colorado. The higher diversity in the materials used for mano and metate sets in the Upper Little Colorado may indicate differences in manufacturing traditions and perhaps or a greater degree of expedient tool manufacture at some southern sites.

Sandstone manos may have been the preferred material for grinding wet substances that would often lodge in the large cavities of vesicular basalt tools (Adams 1999:487), and perhaps for multi (three/four) sided manos intended for rapid wear after long intense grinding sessions (Chapter 4). Otherwise, vesicular basalt was likely the most valued material for groundstone tools as it is more resilient to wear (i.e., lasts longer) and puts less grit into food. Heavier materials like vesicular basalt also increase the efficiency of grinding as the added weight helps fractionate substances faster, although at a greater physically toll. While vesicular basalt manos made up only 15% of the entire mano sample, 52% of the analyzed manos with comfort features were vesicular basalt tools. Higher rates of adding comfort features to vesicular basalt manos likely reflect the desires of women to make these heavier tools more manageable and easier to use for extended periods.

Table 6.4. Statistical Summary of Metate Widths and Mano Lengths.

Subregion	Groundstone Measurement	Period	Number	Mean (cm)	Standard Deviation	Min-Max (cm)
CEN	Metate Width	PIII	14	22.6	5.8	16-35.5
	Mano Length	PIII	76	26.6	5.6	9.4-40
		PIV	2	29.2	1	28.5-29.9
EMV	Metate Width	PIII	3	22.5	4.8	17-25.5
	Mano Length	PIII	55	24.6	8.4	6-37.8
		PIV	32	20.5	9.2	6.9-39.5
ULC	Metate Width	PIII	24	23.7	3.7	14.5-30
	Mano Length	PIII	249	21	4.9	8.8-34.5
	Metate Width	PIV	37	24.8	6.4	14-47.9
	Mano Length	PIV	227	22.8	4.8	9.6-35.2

Increases in the length and surface area of manos and metates have traditionally been associated with greater dependence on maize agriculture and/or with needs to produce either larger quantities of flour (intensifying production) or to reduce the amount of time spent grinding (increasing efficiency). While increases in surface area are important, the continued presence of smaller manos and metates or distinct modes in metate surface area may also indicate increasing specialization in metate manufacture and use. Ethnographically, this kind of size specialization in groundstone tools is well-documented for the Maya (Searcy 2011) where metate manufacturers produce three different size categories of metates intended for grinding different substances (e.g., spices, coffee). Tools intended for grinding maize having the largest surface area. Only 16 complete metates were analyzed in this study and all of them were from sites in the Upper Little Colorado, limiting the usefulness of this data for examining regional patterns. There were no distinct size modes in the complete metates analyzed in the Upper Little Colorado.

78 metates were complete enough to get width measurements of grinding surface areas. While metate width measures are largely (78%) from sites in the Upper Little Colorado or northern Pueblo III period settlements, metate width measures can still be compared with the length measurements of the larger and more representative set of analyzed complete manos (Table 6.4). At the regional scale, mano and metate and length and width measures generally fall between 20-25 cm on average (Table 6.4, Fig. 6.2), although considerably larger and smaller tools continued to be manufactured and used in each settlement area over time.

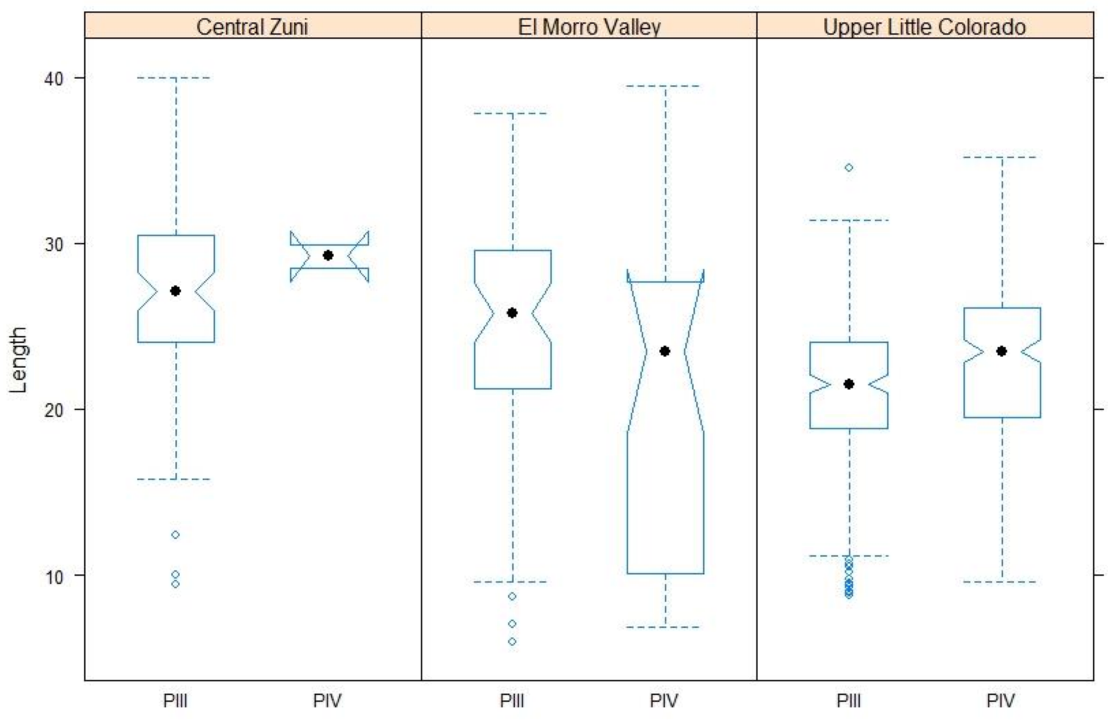

Figure 6.2. Mano Length (cm) by Settlement Area and Period (n=641).

Results of this analysis closely match with mano average length and minimum-maximum ranges reported by Jenny Adams (1999: Table 3) and suggest that the majority of manos recovered at Pueblo III and IV period sites were being used on large flat metates. While mano lengths are highly variable over time in the El Morro Valley area, manos from the Upper Little Colorado are generally smaller than manos from northern settlements (Welch's t-test: $t_{welch} = -4.64$, $p<0.01$). While this might suggest that more manos in the Upper Little Colorado were being used on trough metates which have smaller mean length and surface area measures than flat manos and metates (Adams 1999), very few manos exhibited edge wear patterns associated with trough metate use. As such, the smaller mano size in the Upper Little Colorado suggests somewhat less intense food preparation activities compared to more northern settlement areas.

Metate Types

Across the Cibola region, settlements occupied in the Pueblo II period have notably higher percentages of basin and trough metates in groundstone assemblages than in later periods (Fig. 6.3). Only 3% of the metates analyzed in this study from Pueblo III and IV period settlements were basin types (Table 6.6). Basin metate types were only recovered from sites in the Upper Little Colorado, largely from the Pueblo III period Coyote Creek site. While inconsistencies in the reporting of flat/concave types make it difficult to discern temporal patterns in the use of this type, data collected for this study suggest that the use of flat/concave metate types also diminished over time. Pueblo III and IV period flat/concave metate types represents 15% of the metates analyzed in this study with majority (59%) of these recovered from settlements in the Upper Little Colorado (Table 6.6).

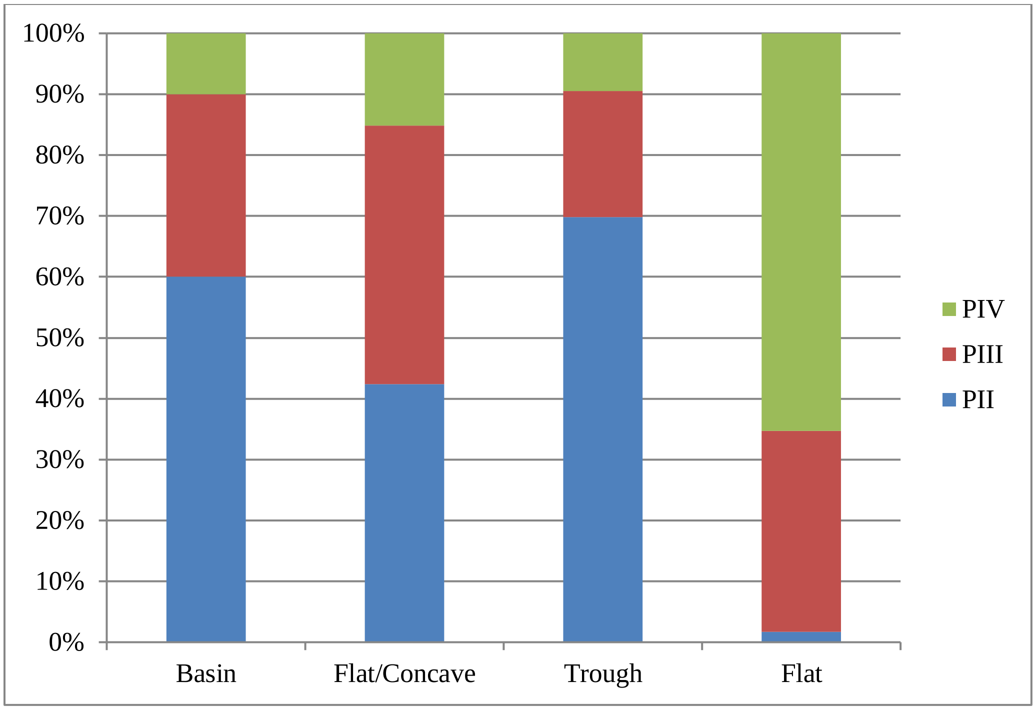

Figure 6.3. Percentage of Cibola Metate Types A.D. 900-1400.

Trough and flat type metates are more formally manufactured tools and are associated with larger surface areas, use in formal grinding features, and more intense scales of food preparation. Trough metates are optimal for containing hard/dried substances that might fly off the metate surface when being ground, while flat metates are suited for processing wet/soft substances (Chapter 4). Trough metates account for 15% of metates analyzed in this study, with most (74%) recovered from sites in the Upper Little Colorado area, and especially at the Pueblo III period Coyote Creek and Pueblo IV period Hooper Ranch sites (Table 6.6). There were no trough metates recovered from Pueblo IV period sites in the Central Zuni area, and no trough metates were present in groundstone assemblages in the El Morro Valley in either period, suggesting increasing technological distinctions between these areas over time.

Table 6.5. Cibola Metate Types A.D. 900-1400.

Period	Number of Sites	Number of Metates	Basin	Flat/Concave	Trough	Flat
PII	7[1]	203	12%	42%	44%	2%
PIII	13[2]	180	6%	42%	13%	39%
PIV	12[3]	355	1%	15%	6%	78%
TOTAL	32	738	5%	29%	18%	48%

1: Bradford 1980; Damp and Waseta 2004; Fletcher 1994; Gilpin et al. 2004; Roberts 1932; Smith 1973; ZCRE 2001
2: Martin et al. 1967
3: Burton 1990; Smith 2009

The remaining 67% of metates analyzed in this study were of the flat type (Table 6.6). Paul Martin and colleagues (1964: 67) have suggested that increases in the frequency of flat metates over time are associated with the use of mealing bins. While this may generally be true, trough metates have also been recovered in mealing bins across the Cibola region in all the periods considered here (e.g., DeGarmo 1975; Martin et al. 1962; Roberts 1932). Overall, metate type data from this study suggest that by the time households were living in aggregated villages, the forms and manufacture techniques of metates had begun to change, and that metates manufactured and used in Pueblo IV nucleated pueblos are clearly dominated by flat metate types (Fig. 6.3). Changes in metate type (and size) likely indicate both an increase in the intensity of food production and suggest a shift in cuisine that resulted in more labor and time being expended grinding soft/wet substances like softer flour kernels, and possibly soaked, alkaline-processed kernels and dough (*masa*).

Table 6.6. Cibola Metate Types by Settlement Area and Period.

Subregion	Period	Site	n=	Basin	Flat/Concave	Trough	Flat
CEN	PIII	11,527	18	0%	16%	6%	78%
CEN	PIII	11,530	6	0%	33%	0%	66%
CEN	PIII	Hinkson	13	0%	8%	23%	69%
CEN	PIII	Jaralosa	1	0%	100%	0%	0%
CEN	PIV	Heshot uła	3	0%	0%	0%	100%
CEN	PIV	Lower Pescado Village	3	0%	0%	0%	100%
EMV	PIII	Los Gigantes	4	0%	75%	0%	25%
EMV	PIII	Pettit	5	0%	60%	0%	40%
EMV	PIII	Scribe S	8	0%	13%	0%	87%
EMV	PIII	Tinaja	5	0%	20%	0%	80%
EMV	PIII	LA 132353	10	0%	0%	0%	100%
EMV	PIV	Atsinna	3	0%	0%	0%	100%
EMV	PIV	Mirabal	6	0%	0%	0%	100%
EMV	PIV	Pueblo de los Muertos	11	0%	0%	0%	100%
ULC	PIII	Coyote Creek	41	10%	17%	24%	49%
ULC	PIII	Rim Valley	3	0%	33%	66%	0%
ULC	PIII	Rudd Creek	2	0%	100%	0%	0%
ULC	PIV	Hooper Ranch	30	3%	23%	54%	20%
ULC	PIV	Rattlesnake Point	18	6%	6%	0%	88%
ULC	PIV	Baca Pueblo	2	0%	100%	0%	0%
ULC	PIV	Casa Malpais	22	0%	0%	9%	91%
ULC	PIV	Table Rock	15	0%	0%	0%	100%
		Total	**229**	**6**	**35**	**34**	**154**

Trough Metate Forms

Differences in the forms of trough metates have been argued to be indicative of distinct technological traditions and learning frameworks. Jenny Adams (1994) documented this diversity in trough metate forms at the Pueblo IV period Point of Pines pueblo, attributing the simultaneous manufacture and use of 3/4 and full trough metates at the settlement to the mixing of more distant northern migrant populations (3/4 trough) with local (full trough) producing groups. There considerable diversity in the forms of trough metates recovered from Pueblo II period sites across the Cibola region (e.g., Bradford 1980; Damp 2001; Gilpin et al. 2004; Lippmeier 1994; Smith 1973). Sites in more southern and western portions of the Cibola region in the Pueblo II period generally have assemblages with mixtures of full, 3/4, and Utah style trough metates, to the north and east 3/4 and Utah types are more common. The diversity of manufacturing traditions in the Pueblo II period and its subsequent decline in the Pueblo III and IV periods may reflect a decrease over time in population circulation and interaction across the Cibola region, something others have suggested based on changes in architectural and decorated and utilitarian ceramic technological traditions (e.g., Mills 2007b; Peeples 2018).

Table 6.7. Cibola Trough Metate Forms A.D. 1150-1400.

Subregion	Period	Site	Metate Assemblage (n=)	Full Trough	3/4 Trough	Indet. Trough
CEN	PIII	Hinkson	13	3	--	1
CEN	PIII	Jaralosa	1	1	--	--
CEN	PIII	11,527	18	--	--	1
ULC	PIII	Coyote Creek	41	3	--	7
ULC	PIII	Rim Valley	3	--	--	2
ULC	PIV	Hooper Ranch	30	1	1	14
ULC	PIV	Casa Malpais	22	--	--	2

The majority (75%) of trough metates analyzed in this study (Table 6.7) were recovered in a fragmented state making it impossible to further assign them to any particular trough form. All of the full trough metates analyzed in this study were recovered from more western parts of the Cibola region in the Upper Little Colorado and Jaralosa Draw portion of the Central Zuni area. The only intact 3/4 trough metate recorded in this study was recovered from Hooper Ranch in the Upper Little Colorado area, making this the only settlement in the Pueblo III *or* IV period to have both full and 3-4 trough metates present. No Utah trough metates were recorded at Pueblo III or IV period sites in this study. The sustained diversity of trough metate types at more western sites in the Cibola region over the Pueblo II through IV periods suggest the persistence more diverse food preparation traditions and cuisine, likely reflecting higher levels of interaction, intermarriage, and the mixing of local and more distant migrant groups into these areas in the late 13th century.

Mano Use-Life

Patterns of mano wear, including the number of sides used can be used to understand patterns in the intensity of tools use. While one sided manos are more expedient tools, three and four sided manos signal a more extreme use and a greater concern with maintaining numerous usable grinding surfaces for prolonged grinding sessions (Chapter 4). Three and four sided manos are likely tools used for the intensive grinding, and perhaps especially with the final stages of producing very fine maize flours. This interpretation is supported by differences in the length of manos recorded in this study, as one-sided manos were on average the shortest and three and four sided manos were the longest (Table 6.8).

One sided manos make up a small percentage (11%) of mano assemblages, although one sided manos make up half of the assemblage of the Pueblo III period Rudd Creek Pueblo site in the Upper Little Colorado (Table 6.8). Overall the majority (68%) of manos recovered from Pueblo III and IV period sites in the Cibola region were two-sided and show signs of wear management by just flipping (the wedged B-type) (29%) or the slightly more managed C-type where the mano is flipped and rotated (69%) (Table 6.8). Only 1% of manos analyzed in this study showed signs of wear management through rotation alone (D-type). The majority of these rotated manos (61%) were recovered from sites in the El Morro Valley, and the remainder were at sites in the Upper Little Colorado. It is possible that differences in the wear management of two-sided manos many indicate some diversity in learned grinding motor habits in these areas.

Table 6.8: Number of Used Sides and Wear Patterns on Cibola Manos.

Subregion	Period	Site	n=	one-side	two-sides			three-sides	four-sides
				A	B	C	D	E	F
CEN	PIII	11,527	36	44%	17%	33%	0%	6%	0%
CEN	PIII	11,530	79	22%	24%	52%	0%	2%	0%
CEN	PIII	Hinkson	55	0%	33%	44%	0%	23%	0%
CEN	PIII	Jaralosa	3	0%	33%	66%	0%	0%	0%
CEN	PIV	Heshot uła	22	0%	0%	59%	0%	41%	0%
CEN	PIV	Lower Pescado Village	19	0%	11%	53%	0%	32%	4%
EMV	PIII	Los Gigantes	20	30%	5%	35%	15%	15%	0%
EMV	PIII	Pettit	57	25%	37%	23%	5%	10%	0%
EMV	PIII	Scribe S	90	8%	22%	67%	1%	2%	0%
EMV	PIII	Tinaja	15	0%	13%	20%	20%	47%	0%
EMV	PIII	LA 132353	23	4%	18%	78%	0%	0%	0%
EMV	PIV	Atsinna	18	0%	11%	44%	0%	39%	6%
EMV	PIV	Cienega	35	6%	11%	23%	9%	49%	2%
EMV	PIV	Mirabal	52	12%	13%	38%	0%	29%	8%
EMV	PIV	Pueblo de los Muertos	170	3%	15%	44%	1%	36%	1%
ULC	PIII	Coyote Creek	402	7%	26%	49%	0%	17%	1%
ULC	PIII	Rim Valley	39	18%	10%	34%	0%	38%	0%
ULC	PIII	Rudd Creek	39	51%	18%	13%	18%	0%	0%
ULC	PIV	Hooper Ranch	212	1%	8%	71%	0%	20%	0%
ULC	PIV	Rattlesnake Point	91	3%	20%	49%	2%	26%	0%
ULC	PIV	Baca Pueblo	4	0%	25%	75%	0%	0%	0%
ULC	PIV	Casa Malpais	99	8%	28%	37%	0%	27%	0%
ULC	PIV	Table Rock	232	0%	20%	41%	0%	32%	7%

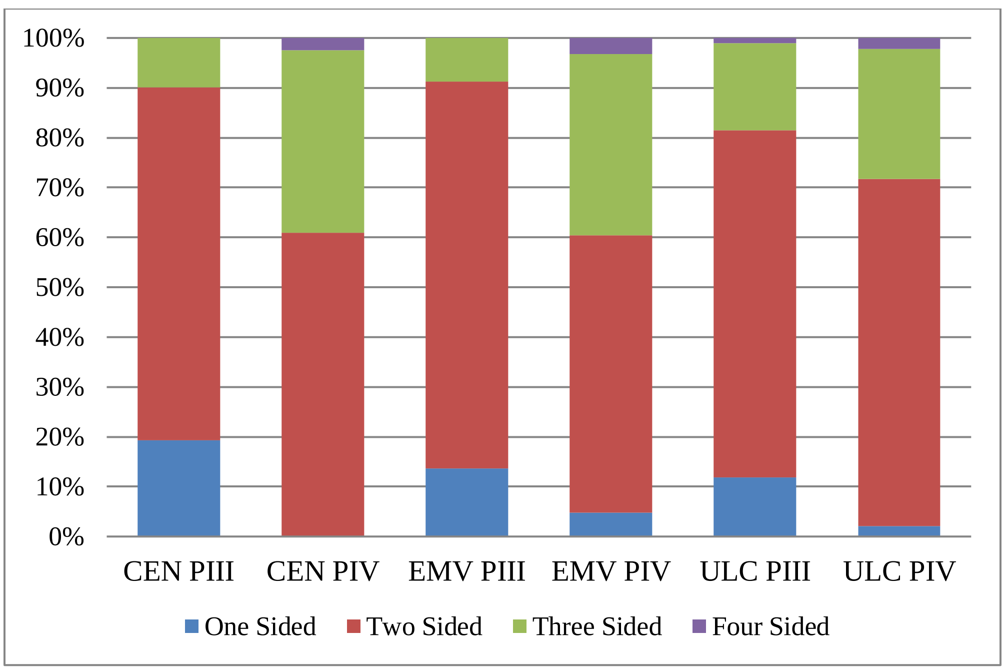

Fig. 6.4. Percentage of Manos by Number of Used Sides.

Three and four sided manos account for 22% and 2% of the analyzed mano assemblages respectively. A significant increase (X^2=452.5, df=2, p<0. 001) in the percent of three and four sided manos can be observed between Pueblo III and IV period mano assemblages across the Cibola region (Fig. 6.4). Increasing percentages of three/four sided tools suggest that there was a shift in household grinding toolkits following population aggregation and settlement nucleation across the Cibola. As scales of food production increased and larger quantities of likely maize flour varieties were grown (Chapter 5), increasing percentages of three/four sided manos suggest that households adjusted their grinding toolkits in order to produce more flour and/or more finely processed flour.

Table 6.9. Statistical Summary Mano Lengths by Number of Used Sides and Wear Pattern.

Wear Pattern	Period	Number	Mean (cm)	Standard Deviation	Min-Max (cm)
A	All	60	20.7	7.2	6.9-39.5
B	All	120	22.3	5.1	8.8-33.6
C	All	354	22.7	6.1	7-40
D	All	7	19.6	8.2	7-27.3
All 2-sided	All	481	22.6	5.9	7-40
E	All	91	23.5	5	6-36.5
F	All	9	26.5	3	19.8-30

In the Pueblo IV period, the highest percentages of three/four sided manos are found at settlements in the Central Zuni and El Morro Valley areas, where in some cases nearly half of grinding assemblages comprised three or four sided manos. In the Upper Little Colorado, Pueblo III period sites vary greatly in the percentages of three and four sided manos present, but have somewhat higher percentages of multi-sided manos compared to more northern sites. Pueblo IV period sites in the Upper Little Colorado show a more modest increase in the percentage of three/four sided manos, suggesting that changes in the scales of food production in the Pueblo IV period may have been less dramatic than in the Central Zuni and El Morro areas. One of the assemblages in the

Upper Little Colorado area with the highest percentages of three and especially four sided manos is from Table Rock Pueblo, a Pueblo IV period settlement that very likely was occupied by large groups of more western migrants from the Hopi Mesas (Duff 2002:107).

Summary

Metate types changed greatly following population aggregation and settlement nucleation across the Cibola region. The reduction in the diversity of trough metate forms over time suggests decreasing rates of population circulation and interaction across the Cibola region. I argue that simultaneous increases in the percentage of flat metates types indicate a regional scale shift in the types of foods being processed, although perhaps to a lesser degree in the Upper Little Colorado area. Furthermore, increases in the size and percentage of manos with multiple sides similarly support arguments for widespread increases in the intensity of daily food preparation activities through time, and that finely processed flours were increasingly central to cuisine in the Pueblo IV period. In the following section I draw on mealing bin data to examine how the organization of food preparation activities changed as the amount of labor involved increased.

Mealing Bins and the Organization of Food Preparation

Permanent grinding stations provide insights into the nature and organization of food processing activities. Mealing bins are present in the Cibola region by at least the Pueblo II period, and slab-lined mealing bins remain the most common across the Cibola region and the only type recorded in the Central Zuni[2] and El Morro Valley areas in the Pueblo III and IV periods (Peeples 2011:248, Fig 7.8). Traditions in the construction of mealing bins are more diverse to the south. In the Upper Little Colorado in addition to slab-lined bins adobe coping was occasionally also used to embed metates (Martin et al. 1961). While single bins allow only one person to process food at a time, multiple bins allow several grinders to work together and perhaps complete different stages of grinding maize into finer and finer flour in an assembly-line like fashion (as in the ethnographic examples discussed above). Across the Cibola region mealing features with multiple bins and metates of varying coarseness have been recorded (e.g., Hill 1970: 48; Roberts 1932:37). Other examples indicate the same technique of using groundstone tools of different materials and/or levels of coarseness was also achieved by using manos of different materials (e.g., Bradford 1980; Martin and Rinaldo 1960).

Variations in the number of bins in grinding facilities are often thought to indicate differences in the organization of food preparation and likely the size of social groups involved in them (Adams 1993; James 1994: 251-253; Ortman 1998; Peeples 2018). Generally, settlement areas in northern portions of the Cibola region have fewer mealing bins within settlements and somewhat fewer bins within grinding facilities compared to more southern areas. Pueblo III period sites in the Central Zuni and El Morro Valley have grinding facilities with anywhere between one to three bins. Sites in the Upper Little Colorado have mealing facilities that range from one to five bins, though two to three bins are the most common. The Pueblo III to IV period transition is associated with decreases in the average number of mealing bins in grinding facilities over much of the northern U.S. Southwest and in some portions of the Cibola region (Ortman 1998: Table 9.2; but see Peeples 2018). Only single mealing bins are recorded at Pueblo IV period sites in the Upper Little Colorado. While limited excavation data make it difficult to compare changes in the number of bins in grinding facilities in the Central Zuni area, the only recorded mealing facilities in the El Morro Valley also have a single bin in the Pueblo IV period.

In other portions of the northern U.S. Southwest, multi-bin grinding facilities are increasingly established in more public courtyards, plazas, rooftops, or other non-domestic mealing facilities in the Pueblo IV period (Ortman 1998). Ortman has argued that this change in the location and size of grinding facilities reflects the increasing social importance of communities as opposed to extended families (Ortman 1998:183). Available grinding facility data from the Cibola region provide mixed support for this argument (Ortman 1998:173; Peeples 2018). There is little to no current evidence for large communal grinding facilities in plazas, rooftops[3], or specialized mealing rooms at Pueblo IV period settlements in the Cibola region, although this may partially be the result of inconsistencies in recognizing or recording remains of mealing facilities from second story and roof deposits (Adams 2002; Ortman 1998; Peeples 2018). Overall, evidence for only single mealing bins in the Pueblo IV period in the settlement areas examined in this study suggest that that as nucleated pueblos were established there was a decrease in the social scale of food preparation and likely an increase in the intensity of food preparation work within individual households.

Grinding and Groaning: Why Make (more) Breadstuffs?

Patterns in mano and metate manufacture and use discussed in this chapter dovetail closely with the analyses of maize ubiquity and row-number analyses discussed in Chapter 5 (Fig. 6.5). Together evidence of food production and preparation activities suggest that, despite some persistent north-south differences in food production and processing practices, social transformations across the Cibola region in the late 13th century involved important changes in: (1) cuisine in relation to the increasing importance of finely ground maize flours; and, (2) related increases in the labor devoted to daily food preparation activities. What is less clear is why these changes occurred in these periods, and how this relates to apparent changes in the social scale of household food preparation activities and the scale and frequency of supra-household commensal events.

From a nutritional and energetics perspective, preparing large quantities of finely processed maize offers little net-benefit, least of all to those doing the preparation work. Grinding cereals of any kind is an incredibly strenuous task, especially when done in a fixed position at a mealing bin, as skeletal evidence from across the Southwest indicates (Crown 2000b:224; Spielmann 1995). Devoting hours of every day to grinding food also takes time away from related food production and preparation tasks. There are numerous ways of preparing maize documented at Zuni historically that involved little to no grinding of kernels, including hominy, parched popcorn, and mush or other recipes using coarse meal (Appendix G.2). If these recipes were prepared with wood ash or lime (as they often were) these would likely have been just as, if not more, nutritious (see Hayden et al. 2016) than breads made with finely processed flours. Finely processed flours and breads made with them, are both less efficient forms of food to produce and are much more prone to spoilage and pest damage than unprocessed kernels. They may also have a negative impact on dental health, because larger quantities of grit would be introduced into the meal.

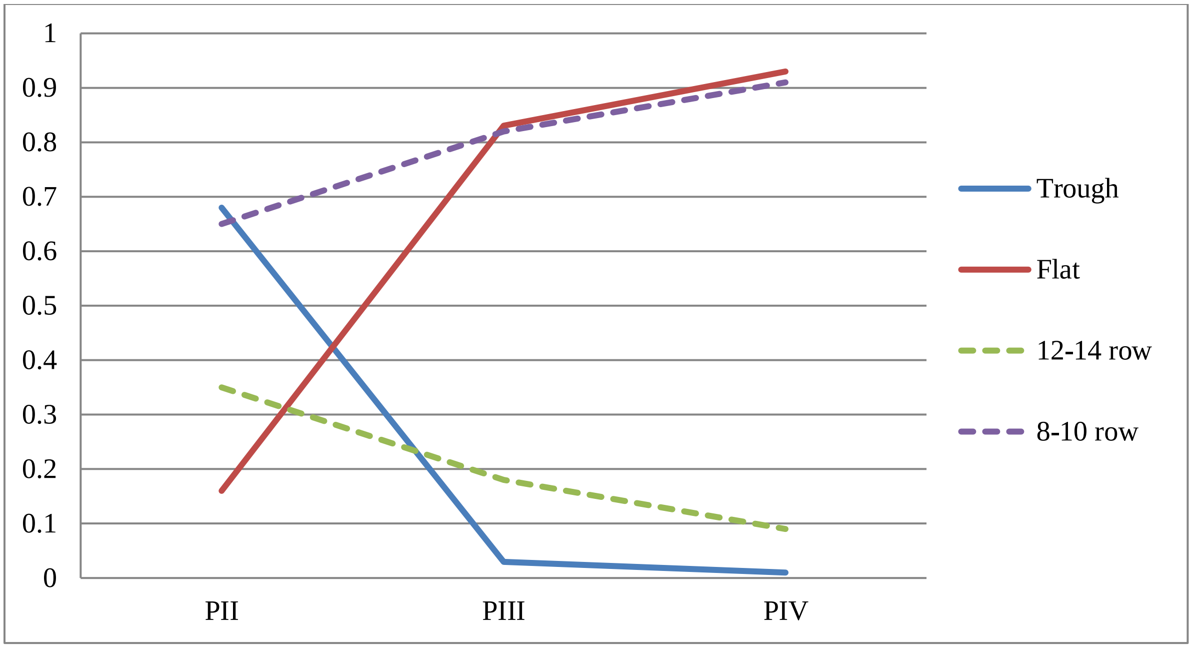

Figure 6.5. Proportions of Metate Type and Maize Row-Number A.D. 900-1400.

Crown (2000c) has proposed that in the U.S. Southwest increases in the time, labor, and amounts of finely processed maize flours in cuisines reflect the need to reduce fuel use. Cooking processed maize is faster and requires less fuel than stewing unprocessed kernels for several hours, although pre-soaking kernels before cooking can dramatically reduce cook times as well (Hayden et al. 2016:81). While concerns over fuel may have been a major factor in decisions about food preparation in some areas of the Southwest, this argument is less convincing for the Cibola region. This is especially the case for aggregated villages and towns located in upland portions of the Central Zuni and El Morro Valley where fuelwood sources are more abundant (Chapter 7). Needs for more transportable foods may also be a factor (Brumfiel 1991; Hastorf 2016:105), although at Zuni historically coarsely ground maize foods were often favored provisions on journeys (Cushing 1920:340-341, 588).

Additional explanations for these changes in cuisine include differences in how coarsely versus finely prepared maize dishes tasted, and to the social values attributed to preparing and serving these foods publicly (e.g., Mills 2008; van der Veen 2003). In terms of the overall experience and flavor of foods, consuming more finely processed flours involves the more rapid absorption of glucose into the bloodstream, hence the higher glycemic index of white versus whole grain breads (Hayden et al. 2016:83). Much like consuming fresh fruits or processed fruit conserves, the effects of consuming breads made of very finely processed flours might have produced a noticeable and appreciated "sugar high" for prehispanic populations in the Cibola region. The understood labor and technical complexity of creating certain finely ground maize dishes likely also have contributed to the appreciation and prestige ascribed to those producing and/or serving finely processed maize foods. Ultimately, I suggest that a combination of the distinctive flavor and social values associated with being able to prepare and share highly processed maize dishes and breads in large villages and towns were a major factor in this shift in cuisine that had such lasting implications for understandings of personhood, gender, and social status across the northern U.S. Southwest.

Chapter Summary

While evidence for changes in the scale or organization of food storage are somewhat ambiguous, the social scale of food preparation activities appears to decrease while the intensity of daily food preparation activities likely increased over the Pueblo III and IV periods. This increase in food preparation intensity is supported by changes in the type of metates being manufactured and used, increases in the size of metates and multi-sided manos, and changes in mano use-wear management that allowed for longer grinding sessions. I argue that these changes in food preparation are linked to changes in cuisine, and the growing importance of finely processed maize flours across the Cibola region in the late 13^{th} and early 14^{th} centuries. In the Chapter 7, I address how increases in the scale of food production and daily food preparation activities map onto changes in the scale and organization of cooking activities and especially the cooking of foods for large commensal events.

Chapter 6 Notes

[1] The lack of vesicular basalt tools at Pueblo IV period settlements in the Central Zuni area is likely due to the small sample size of metates (n=6), which is unsurprising as there has been limited excavation of Pueblo IV period sites in this area.

[2] As with the metate types, mealing bins in the Central Zuni area in the Pueblo II period suggest a greater diversity of construction techniques may have been practiced in this period. While data is limited, mealing bins with adobe coping have been recorded (e.g., Damp and Waseta 2004). Somewhat higher number of bins in mealing features may also have been used in the Central Zuni area in the Pueblo II period (i.e. facilities with three and four bins) (Damp and Waseta 2004; Roberts 1932).

[3] Loose mano and metate data do suggest that rooftop grinding occurred at least at the Pueblo III period site NA 11,530 in the Central Zuni area (Zier 1973), the Pueblo III period Los Gigantes site in the El Morro Valley (EMVPP notes), and the Pueblo IV period Rattlesnake Point Pueblo in the Upper Little Colorado (ULCPP notes).

Chapter 7:

FOOD SINGS IN THE COOKING-POT; COOKING IN THE CIBOLA REGION

"*Food whistles on the spit and sings in the cooking-pot when it is ready, and only women know its music or understand its language* (Cushing 1920:572)."

In this chapter I consider changes in cuisine and commensality across the Cibola region by examining the tools, techniques, and features used, likely by women, to cook for daily meals and special commensal events. Cooking has important nutritional and cultural properties; it is an essential step in rendering prepared ingredients into recognized foods. Cooking creates new flavors, changes textures, and releases enticing aromas; it makes foods safer to eat and more digestible. As was discussed in Chapter 2, the transformative nature of cooking makes this activity a deeply symbolic and socially valued act or even art. While cuisine directs what is cooked and the techniques, technologies, features, and individuals involved; commensality influences how much is cooked, when, and for whom. Cooking involves a both a great deal of knowledge and learned, embodied skill. Even cooking a "simple" meal from scratch involves judging the correct quantities of ingredients, timing different steps, handling various utensils, correctly executing different motions, and regulating sources of heat.

I begin this chapter with an investigation of the kitchen spaces, fuels, ingredients, and tools used to cook meals across the Cibola region in both domestic and extramural cooking features. Examining the spaces used to cook foods and produce daily meals offers an intimate view into cuisine as these features often represent primary deposits and traces of the last meals made in them. I expect embodied cooking techniques and technologies to mirror distinctions previously noted in the use of signature ingredients, flavoring agents, and food preparation technologies at sub-regional scales (Chapters 5, 6). I then draw on a mixture of hearth and ceramic cooking vessel data to compare trajectories in the scale of cooking activities to processes of settlement growth in each of the core study areas (Chapter 3) and to the increases in the scales of food production and preparation examined in Chapters 5 and 6. If changes in food production and preparation were tied to provisioning and hosting larger and/or more frequent public commensal events, I expect to see the specialized manufacture and use of larger cooking vessels (e.g., Blitz 1993; Spielmann 2002) and possibly the construction and use of large communal cooking features like ovens (e.g., Lowell 1999) or roasting pits (e.g., Lindauer 2000). Finally, I examine evidence for one specific change in cuisine, the adoption of specialized sandstone griddles which have been associated with the production of maize flatbreads (e.g., *piki*, *he-we*, *mo-wa*) and the development or adoption of new integrative ideological and religious forms across the northern U.S. Southwest in the late 13th and early 14th centuries (Adams 1991; Crown 1994; Dedecker 2005; Beck 2001; Robbins et al. 1916; Snow 1990).

Cibola Cooking and Cuisine: Ethnographic and Archaeological Evidence

While the earliest forms of cooking often likely involved skin or baskets containers heated with hot stones (Cushing 1920:224-225, 254-255; Ellwood et al. 2013), a range of intra- and extramural thermal features, roasting pits, and ovens were also used in the Cibola region for thousands of years. From the Pueblo II period onwards, available evidence suggests that these cooking features were located in masonry rooms and kivas, on rooftops, in ramadas, courtyards, plazas, and near agricultural fields (e.g., CARP notes; Cushing 1920; EMVPP notes; HARP notes; Martin et al. 1961, Martin et al. 1962;

Peeples 2018; ULCPP notes; Zier 1973). The cooking for large commensal events historically (and today) at Zuni often takes place in large extramural domed or "beehive" ovens, and previously in rooms with oversized hearths where *he-we* slabs were installed (Cushing 1920:255-257, 303-305; Edaakie 1999; Smith et al. 1966:27, 116; Stevenson 1904:293). While these cooking features and spaces could have seen some use year-round, these would have been especially active areas in the busiest ceremonial times of the year (mid-summer and early winter) or when celebrating important life events (e.g., births, kiva initiations). More informal, large roasting pits were historically excavated and used near agricultural fields to roast green corn that would not have time to ripen before frost in the fall (Cushing 1920:204-208; Stevenson 1904:367).

Historic records document a diversity of cooking techniques at Zuni (Edaakie 1999; Appendix G.1., G.2). Plant ingredients were often steamed (Cushing 1920:299-300; Stevenson 1915: 65-67), toasted (Cushing 1920:165-166, 267), boiled (Allen 1995: 26; Cushing 1920: 297-298; Stevenson 1904: 363, 1915:74) or baked (Allen 1995:34; Cushing 1920: 255-257; Stevenson 1904: 366) in ceramic bowl and jar containers over hearths or in heated pits and ovens. At times various ingredients and breads were also toasted and baked directly on hot coals or in ash features (Cushing 1920:229-234, 252-254; Stevenson 1904:293, 1915:67), or fried on prepared stone slabs and griddles (Cushing 1920:228, 331-333; Stevenson 1915:73-74). For meat, especially larger game like deer, it is likely that the most common treatment was stewing (Stevenson 1904:368) and to a lesser extent roasting or drying to make jerky (1904:368-369). Smaller mammals and birds were often skinned and spitted to cook over coals (Cushing 1920:81); tossed entire into a fire to char (1920:594) and then mashed into a pulp or reduced to strips of meat and boiled or roasted over a fire (1920:538, 597-598).

Cibola Kitchens and Cooking Features

In this section I consider evidence for differences in cuisine across the Cibola region by examining architectural features of "kitchen" spaces, cooking techniques, technologies, and the remains of ingredients sometimes left inside. Cooking features recorded in prehispanic periods in the Cibola region include domestic and extramural hearths, roasting pits, and ovens (Appendix F.1). Variations in the form, size, and placement of these features likely indicate differences in learned architectural traditions as well as in in what and how much was being cooked and the techniques employed (e.g., roasting, frying). As with mealing bins, the locations of hearths not only would affect the availability of light and heat, but also influence the nature and extent of the social interactions of those cooking at hearths located in the corners or sides (northern Cibola) or in the centers of the rooms (southern Cibola) (Peeples 2011:241-246). Most hearths recorded in the Cibola region are the rectangular slab-lined type that is embedded into the floor (Peeples 2011:241) although other hearth forms were also constructed (Chapter 4, Appendix F.1). There is little temporal variation in the construction style or placement of hearths within each settlement area examined here over the Pueblo III to IV period transition.

Table 7.1 lists the number of thermal features recorded at each site in this study, and denotes the presence, absence, or number of various extramural thermal features, hearth modifications, or additional features like ash bins and pot-rests. Differences in excavation strategies make it difficult to confidently compare temporal trends in thermal features, especially for extramural features. Overall however, few sites provide evidence for the construction and use of large extramural hearths, roasting pits, or ovens.

Table 7.1. Extramural Thermal Features and Domestic Hearth Modifications.

Period	Sub-Region	Site	No. Thermal Features Recorded	Extramural Hearths (F) / Roasting Pits (R)	Double/Triple Hearths	Ash Features	Pot Rests
PIII	CEN	Hinkson	2	--	--	--	--
PIII	CEN	Jaralosa	0	--	--	--	--
PIII	CEN	NA 11,527	5	--	1	1	--
PIII	CEN	NA 11,530	19	F, R	6	2	1
PIII	EMV	LA 132353	6	--	--	2	
PIII	EMV	Pettit	37	--	3	6	2
PIII	EMV	Los Gigantes	6	F, R	1	2	2
PIII	EMV	Scribe S	18	--	--	--	2
PIII	EMV	Tinaja	4	--	1	--	--
PIII	ULC	Coyote Creek	15	--	--	2	--
PIII	ULC	Rim Valley	7	--	--	--	1
PIII	ULC	Rudd Creek	8	--	--	2	1
PIV	CEN	Heshot uła	6	R	1	--	1
PIV	CEN	Lower Pescado	2	--	1	1	--
PIV	EMV	Atsinna	12	--	--	--	--
PIV	EMV	Mirabal	5	--	--	--	--
PIV	EMV	Pueblo de los Muertos	15	R	2	1	--
PIV	ULC	Baca	0	--	--	--	--
PIV	ULC	Casa Malpais	4	--	--	--	--
PIV	ULC	Hooper Ranch	14	--	--	4	6
PIV	ULC	Rattlesnake	4	--	--	1	--
PIV	ULC	Table Rock	19	--	1	2	5

In addition to single slab-lined hearths, rooms also occasionally contained sets of double or triple slab-lined hearths that were often constructed in rows with shared slab walls. These multiple hearths appear to have been constructed almost entirely in the Central Zuni and El Morro Valley areas (Table 7.1). Historic accounts suggest that at Zuni, multiple fireplaces in habitation rooms were dedicated to different cooking tasks (e.g. roasting meat, baking, boiling) (Baxter 1882:80; Cushing 1920:296-297). Zier (1973:25) similarly has suggested that at least one multi-hearth feature at NA 11,530 in the Central Zuni area was used to roast small game. Overall, I suggest that the construction and use of double or triple hearths in northern Cibola settlements indicates some difference in the organization and/or the execution of different cooking steps or techniques (e.g., roasting, simmering, warming) across the Cibola region.

Other common additions to domestic cooking spaces in the Cibola region include pot rests, sets of stones (2-6) that were embedded within heaths, and ash features which are ash-filled slab-lined bins adjacent to hearths or sometimes simple pit features. While ash features and pot-rests are associated with only a portion of the hearths recorded at any given settlement, one or both of these features were constructed at the majority of sites examined in this study. The absence of these features at some sites may be due to limited or partial excavation of habitation rooms and/or a failure to recognize or report them by excavators. Ash pits and pot rests have also been recorded at Pueblo II period sites, suggesting that these features are part of longstanding cooking traditions across the Cibola region (e.g., Damp and Waseta 2004; Gasser 1982; Howell 2000).

Pot rests are thought to assist in cooking activities by controlling the flow of air to fuel sources, allowing fuel to be easily replenished for prolonged boiling and stewing, and/or moderating the heating of ceramic vessels or stone cooking implements (e.g., griddles or *he-we* slabs) (Cushing 1920:294-295; Stevenson 1904:362-363). Pot rests were only present in habitation room hearths, and 91% are associated with slab-lined hearths. The majority (90%) of pot-rests recorded in Table 7.1 are from settlements in the Upper Little Colorado and El Morro Valley areas; however, the low recovery rates for the Central Zuni area likely reflect, at least to a degree, the more limited excavation of habitation rooms in this area. While increases in the frequency of rectangular slab-lined hearths in the Arizona Mountain area (Lowell 1999) and the Rio Grande region (Snow 1990) have been associated with changes in agricultural intensity and cuisine[1], these associations are less clear-cut for the rest of the Cibola region. Across the Cibola region, pot-rests in rectangular slab-lined hearths suggest the use of hearths for boiling and stewing maize dishes and/or the cooking with griddles at different settlements in the Pueblo III and IV period. I return to the issue of griddle cooking at the end of this chapter.

The use of ash features is not well-understood in the U.S. Southwest (Lowell 1999:461). One possibility is that slab-lined ash features were constructed to keep supply of culinary ash handy. At Zuni historically, ashes were used to boil and detoxify wild potatoes (*Solanum* sp.) (Cushing 1920:227), although most uses of culinary ash involved the alkali treatment or nixtamalization of different maize dishes. There is a long history of soaking of maize kernels in *a:luwe*, a solution of juniper ash or limestone, which strips the pericarp (outer skin) from kernels (Stevenson 1915:76, Appendix G.2). The same solution was often also added as a form of food coloring that helped fix the blue color in a variety of baked and stewed dishes made with blue maize flour (Allen 1995:26; Edaakie 1999:8; Stevenson 1915:74). Ash features themselves were also used to toast and bake a variety of foods (Appendices G.1, G.2). While likely important in terms of cuisine, and very significant in terms of nutrition and amino acid bioaccessbility as culinary ash (e.g., Katz et al. 1974), ash pits may have had a range of other uses. Slab-lined ash features are also associated with hearths in kivas where, as with habitation rooms, ash features could have served a variety of culinary, manufacturing (e.g., pigment, sources of ceramic flux), and/or ritual needs (e.g. Parsons 1939:464; Stevenson 1904:300).

Hearths and their Contents: Fuels and Ingredients

To address changes in cuisine and commensality in relation to cooking activities, it is important to consider what sources of fuel were being used in intramural and extramural cooking features. Cross-culturally fuel selection is not based only on the local availability of resources but also different needs concerning the kinds of heat produced, how short or long fuels will burn, and the amount of smoke or other kinds of aromas that will be produced (e.g., Adams 2004:184-185; Sobolik et al. 1997). The ingredients, techniques, and cooking features involved in producing particular foods or meals all factor into decisions about fuel use. Roasting meat and starchy plant foods (e.g., agave, green corn) is a relatively slow cooking process, but efficient in terms of fuel resources when done in roasting pits or ovens (Wandsnider 1997). In contrast, frying very finely processed maize batter to make *he-we* takes a matter of seconds, although heating up the slab takes some time and a hot fire (to say nothing of the work involved in preparing the ingredients). Hot-burning fuel sources like juniper have likely long been preferred for most cooking and heating tasks in the Cibola region (Cushing 1920:331-333).

As discussed in Chapter 6, one possible explanation for the changes in the intensity of food preparation, specifically the degree to which maize flour was processed, is that the fine flour reduced cooking times and thus the use of scarce fuelwood resources (Crown 2000c). Evidence for agricultural intensification outlined in Chapter 5 suggests that landscapes around large nucleated pueblos were likely cleared to some degree to expand agricultural fields. However, it is not clear how much field expansion and the fuel needs of large densely concentrated populations would diminish pinyon-juniper woodlands. If concerns over fuelwood availability were a contributing factor to changes in cuisine in the Cibola region we would expect a noticeable shift in the types of fuelwood used in hearths in the Cibola region following population aggregation and settlement nucleation in the late 13th and 14th centuries.

Kohler and Matthews (1988) developed a method for examining processes of deforestation and a reduction in preferred wood resources comparing percentages of wood charcoal remains of slower growing arboreal taxa (e.g., juniper, pinyon) to faster growing woody shrub and riparian species. Available wood charcoal data is most limited for the Central Zuni area, especially in the Pueblo III and IV periods (Brandt and Ruppe 1990). However, studies of wood charcoal in thermal features from settlements along the Jaralosa Draw, and numerous wood charcoal analyses from settlements in the El Morro Valley and Upper Little Colorado areas indicate that juniper, pinyon, and other gymnosperm taxa consistently make up the majority (80-90%) of wood charcoal remains recovered from thermal in the Pueblo III and IV periods (Brandt 1994a; Oas 2016b, 2016c, 2017a, 2017b, 2017c; Pearsall 1973). This suggests the level of deforestation around settlements was not enough to hinder access to preferred fuel sources and, even more importantly, suggests that changes in the intensity of maize grinding and the fineness of flour preparation in the Cibola region were not associated with a need to reduce fuel use.

Roasting and Cooking Animal Foods

The presence of butchering and burning marks on animal bones, in addition to deposition patterns (e.g. mixed elements in middens versus articulated internments), are some of the indicators often used by archaeologists to discern patterns of animal cooking and consumption in the past. The clearest evidence for cooking and consumption are usually present on the remains of larger bodied animals (e.g., deer, turkeys) which are more likely to require some degree of processing and butchering to transport and/or cook. As discussed in Chapter 5, archaeological evidence suggests that domestic turkeys were kept across the Cibola region from at least from the Pueblo II period[2], and that both artiodactyls and turkeys were being produced and procured more intensely during the Pueblo III and IV periods. Evidence for artiodactyl and turkey butchering and burning (likely cooking) is presented in (Table 7.2). While it is clear that both turkeys and artiodactyls show signs of being processed and cooked, concentrations of these valued sources of meat in plaza contexts suggest they were likely more often cooked and consumed for special commensal events as opposed to being part of typical daily or weekly meals (Dean 2001; Potter 1997a; Potter 2000).

Smaller mammals, including several species of lagomorphs and rodents, as well as birds, and fish from the Upper Little Colorado River were likely the most regularly cooked and consumed sources of animal protein across the Cibola region in the Pueblo III and IV periods (Chapter 5, Table 5.3). The ethnographic record for cooking smaller mammals outlined previously suggests that lagomorphs and rodents were more likely to be cooked by being spitted, crushed, and/or roasted or boiled without filleting. These cooking techniques would leave more ambiguous faunal markers for processing and cooking (e.g., burned toes or crushed cranial elements in hearths) (Sobolik et al. 1997; Szuter 1991). Remains of rodents also are more difficult to interpret as some species are burrowers and their presence within archaeological contexts can be the result of intrusive post-abandonment activities. Given these taphonomic ambiguities, and as few analyses of faunal remains in the Cibola region have sampled or reported faunal remains recovered from thermal features, no comparison of faunal remains from thermal features is attempted here.

Table 7.2: Evidence for Butchering and Burning of Turkeys and Artiodactyls.

Period	Sub-Region	Site Name	NISP	AI	TI	Turkey		Artiodactyl	
						Burning	**Butchering**	**Burning**	**Butchering**
PIII	CEN	Hinkson	6202	0.03	0.12	1%	<1%	8%	1%
PIII	CEN	Jaralosa	120	0.01	0.03	<1%	--	--	--
PIII	CEN	NA 11,527	248	0.16	0.45	--	2%	11%	11%
PIII	CEN	NA 11,530	1059	0.13	0.51	2%	1%	11%	11%
PIII	EMV	LA 132353	46	NA	NA	X[1]	X	--	--
PIII	EMV	Los Gigantes	524	0.47	0.55	13%	--	19%	--
PIII	EMV	Pettit	ND	ND	ND	X	--	--	--
PIII	EMV	Scribe S[2]	1363	0.39	0.46	39%	1%	20%	4%
PIII	EMV	Tinaja	855	0.2	0.21	9%	--	10%	0%
PIII	ULC	Rudd Creek	1078	0.35	0.13	15%	--	25%	2%
PIV	CEN	Heshot uła	1807	0.05	0.23	14%[3]	5%	15%	2%
PIV	CEN	Lower Pescado	337	0.1	0.34	6%	1%	3%	5%
PIV	EMV	Atsinna	921	0.25	0.4	2%	--	2%	2%
PIV	EMV	Cienega	3294	0.29	0.54	3%	<1%	5%	2%
PIV	EMV	Mirabal	5006	0.1	0.35	3%	<1%	2%	--
PIV	EMV	Pueblo de los Muertos	13651	0.35	0.48	3%	<1%	1%	2%
PIV	ULC	Baca	2223	0.13	0.04	2%	2%	5%	1%
PIV	ULC	Rattlesnake Point[2]	32586	0.26	0.1	15%	<1%	14%	2%

[1]X-denoted as present but unquantified; [2] Scribe S and Rattlesnake Point Pueblo both show signs of extensive architectural-scale burning, likely somewhat inflating burning rates

Toasting and Cooking Plant Foods

While trash-filled rooms and middens provide an aggregate view into the use and treatment of various food remains, hearths as primary deposits offer a more intimate window into one or a few cooking episodes. As such, comparing botanical remains recovered from domestic hearths can provide insights into cuisine by documenting differences in the ingredients and techniques used to cook meals across each settlement area. In this section, I compare the remains of staple cultigens, signature gathered plants, and flavoring agents across domestic hearth deposits. The presence of more rare plant foods in hearths is also discussed. As maize part (e.g., cob, kernel) information was not always available, I list both percentages of hearths where maize remains of any kind were recovered, and hearths where just maize kernels were recovered (Table 7.3). Because maize cobs were (and are still) often used as sources of fuel, the recovery rate of all maize parts in hearths is less informative than the presence of just maize kernels which provide more direct evidence for the toasting and parching of kernels to eat as popcorn or as a step for preparing other dishes.

As expected, across the three settlement areas, domestic hearths appear to have been used frequently to roast, parch, or otherwise process and cook a range of plant ingredients. Across the region, maize kernels, goosefoot, amaranth, and purslane regularly appear in hearths in the Pueblo III and IV periods, suggesting that these taxa were often parched or toasted. Hearths from the El Morro Valley and Central Zuni areas contain a similar distribution of plant remains, although higher percentages of maize, small seeded annuals like goosefoot, and pinyon nuts in Central Zuni area hearths suggest that these ingredients were being cooked using parching techniques somewhat more often (Table 7.3). Hearths from the Central Zuni area also contained evidence for the use of three flavoring agents, tansy mustard, pepper grass, and tomatillo. I discuss the relatively high (27%) recovery rate of tomatillos in Central Zuni area hearths further below.

Hearths analyzed from settlements in the Upper Colorado area further support the local importance of several signature grassy species (e.g., ricegrass, winged-pigweed) that were discussed in Chapter 5. Several relatively uncommon flavoring agents, chia and plantain, were also recovered from hearths at two Pueblo IV period sites, Casa Malpais and Rattlesnake Point Pueblo (Brandt 1994b; Oas 2017c). As these taxa have been recovered most frequently from settlements in the Silver Creek area (e.g., Mills et al. 1999) and appear at Casa Malpais and Rattlesnake Point Pueblo with other more common southern foods like acorns, manzanita berries, and walnut remains, their recovery hints at the influence of southern migrants and the mixing of cuisines in the Upper Little

Colorado in the Pueblo IV period (Table 7.3). Overall, remains of plant foods recovered from hearths in the Cibola region support previously noted distinctions in local plant use and cuisine outlined in Chapter 5, and suggests that parching and toasting techniques were frequently used to process and cook maize and other small-seeded annual and nut ingredients in each settlement area.

Table 7.3. Plant Remains Recovered from Domestic Hearths AD 900-1400. **Bold** indicates plant food taxa commonly (>20% of sites) recovered across the Cibola Region (Chapter 5, Table 5.4).

	Taxon	CEN hearths n=35	EMV hearths n=42	ULC hearths n=69
Cultigen	**Maize (all)**	94%	67%	67%
	Maize (kernels)	80%	ND[4]	23%
	Bean	6%	5%	4%
	Squash	3%	--	1%
Agrestal	**Amaranth**	6%	10%	3%
	Beeweed	15%	2%	6%
	Chia	--	--	3%
	Dropseed	--	2%	3%
	Globemallow	6%	5%	22%
	Goosefoot	61%	29%	38%
	Tomatillo	27%	--	--
	Pepper Grass	6%	--	7%
	Plantain	--	--	1%
	Purslane	21%	14%	13%
	Ricegrass	6%	--	12%
	Stickleaf	--	--	3%
	Sunflower	3%	--	7%
	Tansy Mustard	3%	--	--
	Winged-Pigweed	--	--	16%
Wild Economic	**Cholla/Prickly pear**	6%	2%	7%
	Hedgehog Cactus	1%	5%	1%
	Juniper	3%	2%	7%
	Manzanita	--	--	4%
	Oak	--	--	1%
	Pinyon	12%	7%	1%
	Polygonum	3%	5%	6%
	Walnut	--	--	4%
	Yucca	6%	2%	6%

Tomatillo: Signature Flavors of the Central Zuni Area

The frequent use of tomatillo (*Physalis* sp.), or *k'e:ts'ido'kya* (Fig.7.1) at Central Zuni areas settlements is intriguing as it indicates very deep historical roots for the use and popularity of this plant as a snack food and condiment. *Idonapshe* a cookbook of traditional Zuni foods by Rita Edaakie provides a recipe for *k'e:ts'ido'kya k'yałk'osenne*, a paste or sauce consisting of 6-10 boiled tomatillos and chunks of roasted green chili peppers that can be eaten plain by dipping green onions in it, or used as a relish on other foods (1999:83). Several ethnographers have also remarked upon the popularity of tomatillo as a sauce and condiment at Zuni over the past century. Vorsila Bohrer noted that chilies and tomatillos were both grown in waffle gardens and used to make a popular sauce during her visits in the 1950s (1960:182). While less botanically precise (as he often was), Cushing documented a similar recipe as provided by Edaakie, "a really superior sauce or condiment-never absent from luncheons and rarely so from other meals… is the pepper, onion, salt, coriander-leaf, and water paste, served from the lava-stone trough in which it has been freshly macerated and crushed (1920:560)." Finally, Stevenson (1915) also commented on the gathering and cultivation of tomatillos in gardens, and described a highly prized sauce or dish made with cilantro, onion, chili, and boiled and crushed tomatillo fruits (1915:70).

The frequent recovery of tomatillo seeds in hearths in the Central Zuni area suggests that tomatillo fruits were often parched, roasted, and/or boiled over hearth features. Archaeobotanical data from Central Zuni settlements indicate that the particular importance of tomatillos in this settlement area can be traced back to at least the Pueblo II period (Chapter 5). While there is little available botanical data available for earlier periods in the Cibola region, studies of coprolites from across the Four Corners indicate that tomatillos were a commonly consumed food by at least some groups in the Basketmaker III period (A.D. 500-700) onwards (Kindscher et al. 2012; Minnis 1989; Stiger 1977; Sutton and Reinhard 1995).

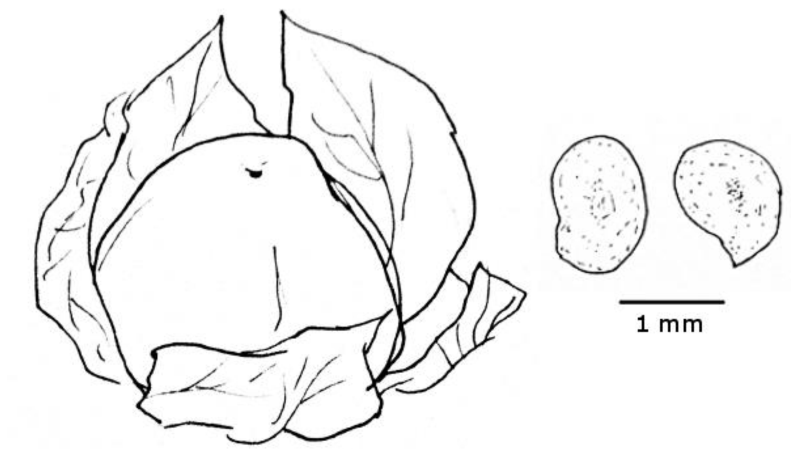

Figure 7.1. Tomatillo Fruit and Seeds (*Physalis* sp.).

While this brief discussion of tomatillo provides only a single example of how flavors were produced and maintained in the Cibola region, the enduring importance of this ingredient in the Central Zuni area highlights the potential of drawing on a range of archaeological and ethnographic sources to examine trajectories in the sensual properties of food. As I discussed in Chapter 2, cuisines are often associated with signature ingredients and distinctive flavor combinations that are tied to culturally shared notions of taste, and to the social construction of identity, memory, place, and history. As such, considering how the sensory aspects of food changed or, as in this case, were conserved over time provides a unique source of insight into how valued foods and flavors were incorporated into daily life and/or special commensal occasions and who may have produced and prepared them.

Cooking Vessels and Cuisine: Vessel Treatment and Heat Exposure

In this final section on cooking and cuisine, I consider differences in the treatment and use of different ceramic vessel forms for cooking. The majority (70%) of utilitarian jar sherds analyzed in this study were Cibola Gray Ware body sherds, of which 98% were from settlements in the Central Zuni and El Morro Valley areas. The remaining 30% were Mogollon Brown Ware vessels, largely (99%) from settlements in the Upper Little Colorado area (Appendix E.3). Differences in cuisine between northern and southern portions of the Cibola region have been suggested based on differences in the treatment (e.g., smudging) and use (exposure to heat) of decorated and Mogollon Brown Ware bowls and jars (e.g., Mills 2007b:216). In this section I discuss patterns in cuisine and cooking techniques drawing on vessel treatment data concerning the smudging, polishing and exposure of utilitarian ceramic vessels to heat though cooking.

If polishing and smudging ceramic vessels improves the durability and the efficiency of heating these containers, as has been suggested (e.g., Schiffer 1990), we would expect that these treatments would be commonly applied to cooking jars. Considering all utilitarian jars, less than 1% were smudged[5] and 21% were polished. Overall, smudging the interior of undecorated jars does not appear to have been commonly practiced, at least in these portions of the Cibola region in the Pueblo III and IV periods. In terms of polishing, most utilitarian jars with polished interiors were Mogollon Brown Ware vessels and nearly all (99%) were from sites in the Upper Little Colorado. It is possible that higher rates of polishing in utilitarian jars in the Upper Little Colorado reflect a desire for more efficient heating of vessel contents. However this would have had limited utility, as experimental studies suggest that decreasing the porosity of vessels only increases the efficiency of heating water as opposed to heating other foods like mush (Pierce 1999:132). For all utilitarian jars, evidence of heat exposure was present on 43%, indeterminate on 41%, and absent on 16% of the analyzed body and rim sherds (Appendix E.3). Unsurprisingly, evidence for heat exposure was split exactly 50-50 for Cibola Gray Ware and Mogollon Brown Ware jars.

In contrast to the jars, only 6% of bowls analyzed for this study had smudged and/or polished interiors, although only Mogollon Brown Ware bowls were expected to have smudged or polished interiors based on type descriptions. The majority (89%) of analyzed Mogollon Brown Ware bowls were smudged and even more (93%) had polished interiors (Appendix E.3). Again, if smudging and polishing vessel interiors was primarily a functional consideration (i.e., seasoning), then we would expect Mogollon Brown Ware bowls to have often been used to cook foods and to exhibit evidence for heat exposure (i.e., exterior sooting). Evidence for direct exposure of ceramic bowls to fire was present on only 2% of the bowls analyzed in this study, of which 90% were Mogollon Brown Ware bowls. Overall, while Mogollon Brown Ware bowls made up only 7% of the analyzed bowl data, a third of the bowls showed indications of direct exposure to heat, which does suggest some differences in cuisine across the Cibola region in terms of the use of ceramic bowls in cooking activities.

It is possible that Mogollon Brown Ware bowls in the Upper Little Colorado area were used for a wider range of activities than other types of decorated bowls or the bowls used in more northern Cibola settlement areas. For example, these bowls could have been used to reheat foods, heat smaller portions of certain foods or water, or perhaps to parch or toast small amounts of kernels or other seed foods (Stevenson 1904:367). The few cases where Cibola Gray Ware bowls or White Mountain Redware bowls show signs of heat exposure could indicate accidents or intermarriage and the mixing of different cooking traditions across the region (Appendix E.3). Ultimately, given limited evidence of smudging and polishing on utilitarian jars, and the relatively low frequency of heat exposure on smudged and polished bowls, it is unlikely that smudging and polishing techniques represent functional needs as much as desire to achieve a decorative effect that was prized in southern Cibola settlements areas (Stone 2018) but not in the Central Zuni or El Morro Valley.

Summary

Available thermal feature data suggest that the majority of cooking activities for daily meals and/or for larger commensal events occurred within household habitation rooms and around rectangular slab-lined hearths across the Cibola Region throughout the 13th and 14th centuries. While “kitchens” across the Cibola region often included ash-features and pot-rests, the use of multi-hearth features at northern Cibola settlements and their absence in the Upper Little Colorado suggests some sub-regional differences in cuisine and the organization of cooking activities. Juniper and pinyon were the preferred sources of fuel and were used extensively to cook and provide heat throughout the Pueblo III and IV periods. Evidence for the cooking of artiodactyls and turkeys is well supported across the Cibola region in the 13th and 14th centuries, as well as the likely frequent toasting of range of small seeded annuals, maize kernels, and nuts especially in the Central Zuni area. Differences in the botanical contents of domestic hearths further support some differences in cuisine across the region in terms of the use of local signature plants and flavoring agents. In the Upper Little Colorado area, the mixing of cuisines following the incorporation of more southern migrants in the Pueblo IV period is indicated. Previously documented differences in cuisine relating to the treatment and use of utilitarian ceramic jars and bowls are also supported by this study and suggest (1) that Mogollon Brown Ware bowls were more often used in cooking activities in southern portions of the Cibola region; and, (2) that the smudging and polishing of ceramic vessels had more decorative and symbolic significance as opposed to a primarily functional purpose.

Feeding a Crowd: Cooking and the Scale of Commensality

While there is limited evidence for the use of communal cooking features like roasting pits and ovens at Cibola settlements, another possible way to address changes in the scale or frequency of household and supra-household cooking activities is to examine patterns in domestic hearth size and the volume of cooking jars. Ethnographic accounts at Zuni suggest that hearths used to cook for stews for feasts or to make *he-we* bread were exceptionally large, often several feet in length (Cushing 1920:255-257, 303-305; Stevenson 1904:293). Archaeological studies of hearths at Hawikku (Smith et al. 1966:23) suggest that hearths ranged between 432-3634 cm^2 with most hearths measuring around 1450 cm^2. As such, I suggest that the construction of large (>3,000-3,500 cm^2) hearths would have allowed cooks to cook meals for large supra-household groups.

If specially prepared sandstone griddles or *he-we* stones were being used, these would be expected to fit just within or over hearths, providing another set of possible expectations in terms of the size of cooking features with more specialized uses. There are few available measures of *he-we* slabs from prehispanic or later periods at Zuni. Cushing (1920:326) describes slabs as large as 4 x 2.5 feet (an astonishing 9,280 cm^2)

though Stevenson (1904:361) provides a far smaller estimate c. 480-1140 cm^2. Likely more reliable comparable measures include: (1) historic *piki* slabs from Hopi measuring 3,484 cm^2 (Stephen 1936:1196); (2) prehispanic slabs from Homol'ovi I averaging 2,508 cm^2 (Dedecker 2005:104); or (3) the large sample of stone "comales" measuring 2,360 cm^2 from 14th century sites the Rio Grande region (Snow 1990:294). While many settlements in the Cibola region have at least one or several hearths with areas that falls within this range (Table 7.4), additional evidence in the form of *piki or he-we* griddle fragments is necessary to make arguments that these hearths were used for specialized flatbread production as opposed to other larger scale cooking activities (e.g., roasting game, cooking large quantities of stew).

Table 7.4. Statistical Summary of Domestic Cibola Hearth Areas.

Period	Sub-Region	Site	No. Domestic Hearths	Mean Hearth Area (cm^2)	SD	CV	Hearth Area Range (cm^2)
PIII	CEN	Hinkson	2	2500	NA	NA	2000-3000
PIII	CEN	NA 11,527	2	2320	NA	NA	2240-2400
PIII	CEN	NA 11,530	19	2044	894	0.44	900-3825
PIII	EMV	LA 132353	6	2213	630	0.28	1400-3200
PIII	EMV	Pettit	36	2140	882	0.41	800-4900
PIII	EMV	Los Gigantes	7	2098	937	0.45	625-3400
PIII	EMV	Scribe S	18	2349	1096	0.47	615-4250
PIII	EMV	Tinaja	4	3400	657	0.19	2500-4000
PIII	ULC	Coyote Creek	15	2681	2077	0.77	400-6944
PIII	ULC	Rim Valley	7	2112	1132	0.55	1512-4650
PIII	ULC	Rudd Creek	9	3901	1257	0.32	1880-5698
PIV	CEN	Heshot uła	4	3243	1133	0.35	1575-4810
PIV	CEN	Lower Pescado	2	3245	NA	ND	2491-4000
PIV	EMV	Atsinna	12	ND	NA	NA	ND
PIV	EMV	Mirabal	6	2328	626	0.27	1500-3174
PIV	EMV	Pueblo de los Muertos	15	2902	1028	0.35	1650-5000
PIV	ULC	Baca	0	ND	NA	NA	ND
PIV	ULC	Casa Malpais	4	2376	900	0.38	1350-3250
PIV	ULC	Hooper Ranch	11	2579	629	0.24	1850-4080
PIV	ULC	Rattlesnake	4	2041	387	0.19	1750-2600
PIV	ULC	Table Rock	19	1939	994	0.51	1200-5865

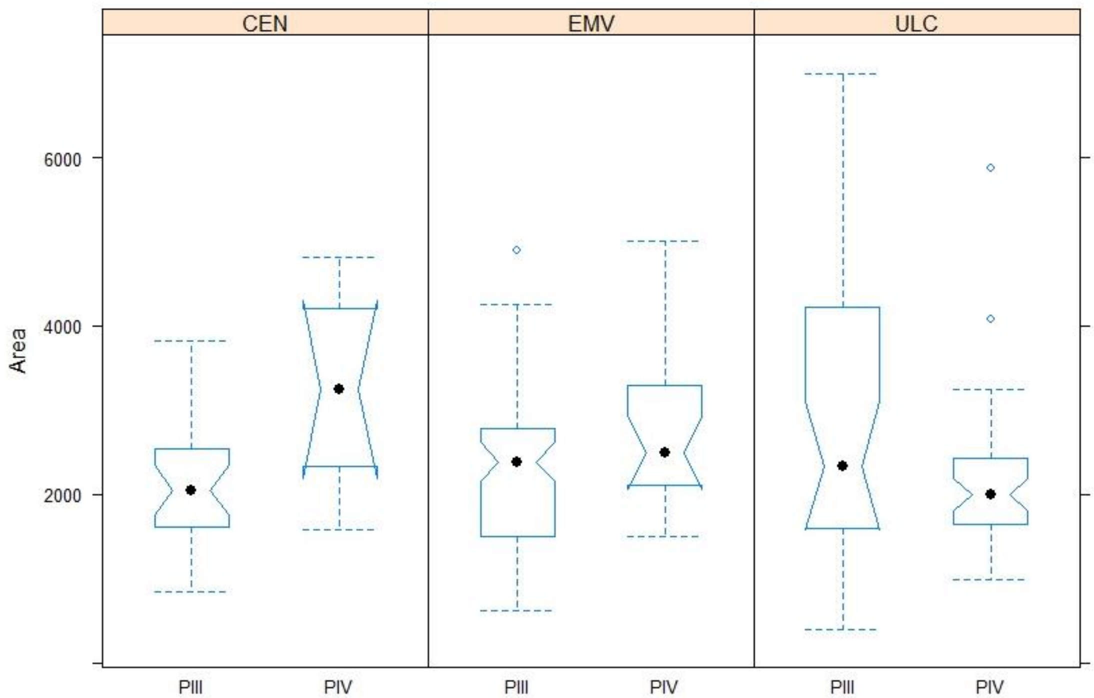

Figure 7.2. Hearth Area (cm^2) by Settlement Area and Period (n=202).

Hearth area measures are highly variable within and between sites and settlement areas in the Cibola region, especially in the Upper Little Colorado area in the Pueblo III period (Table 7.4, Fig. 7.2). There is no relationship between hearth area and the dimensions of the rooms they were installed in, suggesting that differences in hearth size are related to other factors than simply supplying rooms with light or heat. While sample sizes are small, Pueblo IV period domestic hearths in the Central Zuni area are noticeably larger on average than those recorded in the Pueblo III period, perhaps indicating some change in the scale or nature of cooking activities. Hearths in the El Morro Valley and Upper Little Colorado maintain a similar average size. Overall, the presence of large domestic hearths at settlements across the Cibola region in the Pueblo III and IV periods suggests several related factors including changes in cooking techniques (e.g., roasting, baking), and perhaps the need for more specialized hearths used to cook large quantities of food for supra-household commensal events and/or to be used with sandstone griddles.

Corrugated Cooking Jars

Ceramic cooking vessels volume data can also be used to understand changes in the scale of cooking practices and perhaps the frequency of cooking for large commensal events. Studies of utilitarian ceramic vessel source and manufacture in the Cibola region suggest these were largely locally produced (Peeples 2018), making them a useful source of data for examining household cooking activities and the needs of cooks living in aggregated villages and nucleated towns. Mean volume measures for corrugated jars indicate that cooking jars in the Central Zuni and Upper Little Colorado had average jar volumes in the 16-17 liter range, while cooking jars in the El Morro Valley were on average closer to 20 liters (Table 7.5).

Table 7.5. Statistical Summary of Cooking Jar Volumes.

Period	Sub-Region	Site	Sample (n)	Mean Volume (l)	SD	CV
PIII	CEN	NA 11,527	60	18.4	8.1	0.44
PIII	CEN	NA 11,530	76	20	8	0.4
PIII	CEN	Jaralosa	42	16.8	8	0.48
PIII	CEN	Hinkson	135	15.2	7.2	0.48
PIV	CEN	Heshot uła	131	16.1	7.1	0.44
PIV	CEN	Lower Pescado	208	17	7	0.41
PIII	EMV	Los Gigantes	106	18.9	9.3	0.49
PIII	EMV	Tinaja	151	19.5	10.3	0.33
PIII	EMV	Pettit	157	19.9	10.8	0.54
PIII	EMV	LA 132353	65	17.6	7	0.4
PIII	EMV	Scribe S	525	27.7	16.1	0.58
PIV	EMV	Atsinna	100	16.4	9.1	.056
PIV	EMV	Mirabal	172	19.5	13.2	.068
PIV	EMV	Pueblo de los Muertos	578	19.7	11.1	.056
PIII	ULC	Rim Valley	3	16.7	NA	NA
PIII	ULC	Coyote Creek	110	16	8.9	0.56
PIII	ULC	Rudd Creek	113	20.4	10.3	0.5
PIV	ULC	Baca	58	14.7	6.9	0.45
PIV	ULC	Hooper Ranch	153	14.3	6.8	0.48
PIV	ULC	Table Rock	62	15.6	6.4	0.51
PIV	ULC	Casa Malpais	157	16.2	6.7	0.41
PIV	ULC	Rattlesnake	235	17.8	9.1	0.51

Overall, the bulk of daily household meals appear to have been prepared in relatively "small" jars holding somewhere between 15-20 liters (Fig 7.3, Table 7.5), slightly larger than the average decorated storage jar volumes discussed in Chapter 6. This range of cooking jar volumes likely reflects the difficulty of handling larger and heavier cooking jars, as well as how much food was cooked daily to feed a household. As such, I suggest that larger cooking jars (>30 liters) were manufactured and used to cook for supra-household groups and large commensal events.

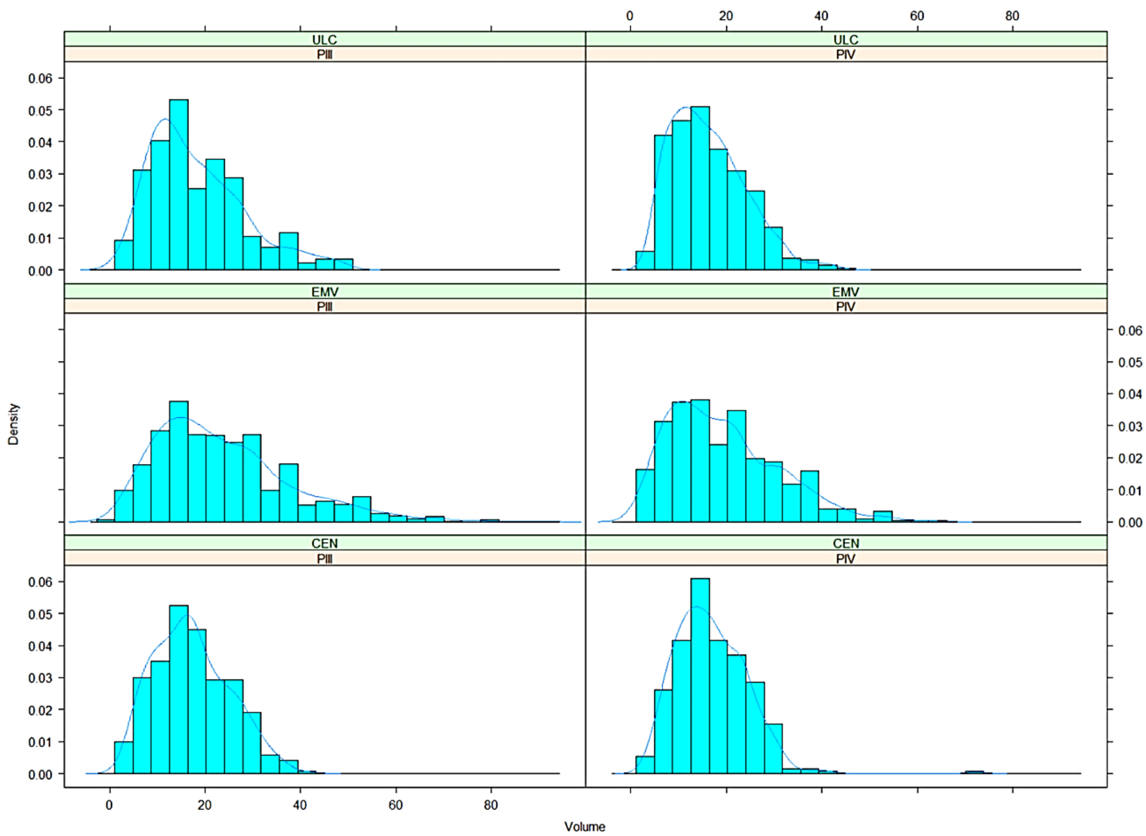

Figure 7.3. Kernel Density Estimates and Histograms of Cibola Cooking Jar Volumes (l) (n=3397).

While the Central Zuni and Upper Little Colorado cooking jars are similar in size, the long tail of larger cooking vessels from El Morro Valley sites (Fig. 7.3) in both periods stands out, as it did with decorated storage jars discussed in Chapter 6. Looking just at the proportion of “large” (>30 liter) cooking jars at each settlement, large cooking jars only make up a small percentage of the analyzed cooking jars in the Central Zuni and Upper Little Colorado areas. In the Central Zuni area they were produced somewhat more frequently in the Pueblo III period (Fig. 7.4). In the Upper Little Colorado, patterns in the percentage of large cooking jars are harder to interpret[6]. In the El Morro Valley, both the Pueblo III and IV periods are associated with the production and use of substantial quantities of large cooking jars, particularly at the large aggregated Scribe S village (Figure 7.4). Overall, ceramic jar volumes indicate that households in El Morro Valley communities engaged in large scale cooking activities more regularly than other settlement areas, likely to provide large amounts of food for communal feasts in plazas.

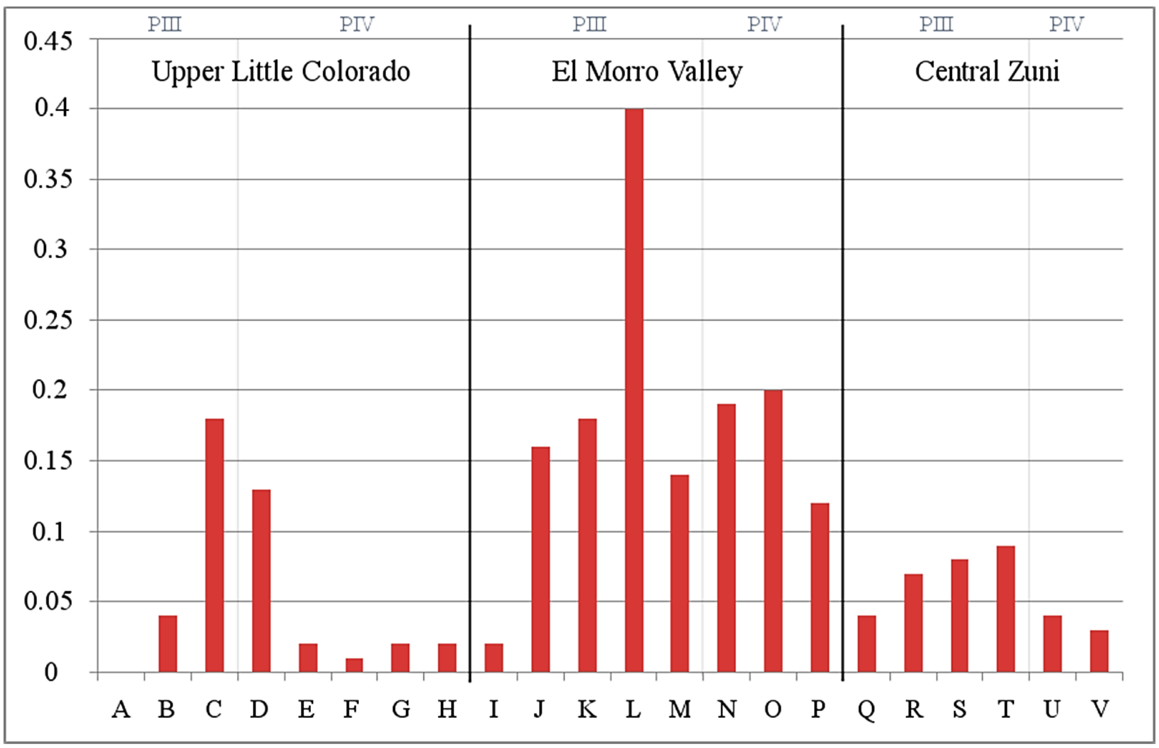

Figure 7.4. Proportion of Large Cooking Jars between 30-50 Liters at each Site[1].

[1]**Upper Little Colorado**: A-Rim Valley, B-Coyote Creek, C-Rudd Creek, D-Rattlesnake Point, E-Baca Pueblo, F-Casa Malpais, G-Hooper Ranch, H-Table Rock; **El Morro Valley**: I- LA 132353, J-Los Gigantes, K-Pettit, L-Scribe S, M-Tinaja, N-Mirabal, O-Pueblo de los Muertos, P-Atsinna; **Central Zuni**: Q-Hinkson, R-Jaralosa, S-NA 11,527,T-NA 11,530, U- Heshot uła , V-Lower Pescado Village.

As discussed in Chapter 4 (Table 4.2), there is an inconsistent relationship between rim diameters and jar volume for large cooking jars (i.e., jars with volumes above 20 liters). Cooking jars with orifice diameters of 20 cm have volumes that range between 20-40 liters. This variation observed in jar volume relative to orifice diameter for larger cooking jars in the Cibola region suggests that large cooking jars were used for a diverse range of cooking or even baking techniques in the Pueblo III and IV periods. Different needs or desires on the part of cooks concerning access to jar contents or restricting water loss during cooking would have influenced the design of ceramic cooking jars. Ethnographic records provide some sense of the diverse techniques and uses for cooking jars historically at Zuni. Documented cooking jar uses include: (1) boiling water to which fine corn meal and other ingredients were added to create mush or dumplings (Cushing 1920:297-298; Stevenson 1904:363, 1915:74); (2) dry toasting or parching kernels and other seed foods in hot sand within jars over the fire (Cushing 1920:165-166); (3) boiling and simmering stews (Cushing 1920:527; Stevenson 1905:367); (4) steaming foods suspended within the jars in smaller ceramic or basketry containers (Cushing 1920:254-255, 299-300); and, (5) pit baking breads inside buried jars (Stevenson 1904: 366) (Appendix G.2).

Summary

Across the Cibola region, while aggregated villages and nucleated pueblos show little sign of communal scale cooking activities, the presence of very large hearths and cooking jars support arguments for households cooking at supra-household scales. Cooking jar volume data suggest that large cooking jars were produced and used far more often by households in El Morro Valley settlements than in other areas, suggesting that cooking and provisioning copious amounts of food for large commensal events was a relatively frequent occurrence there. For settlements in the El Morro Valley, I suggest that the sharing and exchange of food I played an especially important role in processes of population aggregation and settlement nucleation in the late 13th and early 14th century.

Flatbread Cuisines in the Cibola Region

Changes in the varieties of maize being grown and the intensity of grinding activities discussed in Chapters 5 and 6 indicate that across the Cibola region finely ground maize flours became increasingly important parts of cuisine in the Pueblo IV period. In this section I consider how these changes in cuisine were also linked to the adoption of the special flatbread foods (e.g., *piki*, *he-we*). Historically, large slab-lined hearths and presence of pot-rests are specifically associated with cooking flatbread. However, in the Cibola region during the periods considered here, these features by themselves, are not sufficient evidence of the cooking of specialized flatbreads on *piki* or *he-we* stones. It is possible that finely ground maize flours were instead used for a wide range of other baked breads, dumplings, and tamales that also made with finely ground maize flours, as is known for Zuni (Appendix G.2). In this final section I consider evidence for the adoption and use of specialized griddles used to prepare flatbread foods.

The earliest evidence for the use of special griddles to make flatbreads or tortillas in the U.S. Southwest comes from the Hohokam region in southern Arizona ca. A.D. 1150-1200 (Beck 2001). Available evidence suggests that flatbreads produced by cooks in the Hohokam region were prepared on ceramic *comales* and were cooked over hot coals (Beck 2001:204). This cooking technique differs from flatbread production in the northern Southwest where archaeological evidence and historic records indicate that cooking occurred on large and specially treated sandstone slabs supported over open flames in a hearth (Cushing 1920:255-257, 303-305; Dedecker 2005; Stevenson 1904:293). Limited recovery of *comales* suggests that tortillas or other flatbreads produced in the Hohokam region may have only been produced and consumed on special occasions (Beck 2001:211) The relationships between Hohokam flatbread traditions and those documented historically and archaeologically at Western and Eastern Pueblos is not well understood, although the appearance and adoption of flatbread foods have been linked to other important changes in religious practice and social identification associated with the use of Salado Wares and to the spread of new religious ideologies (e.g., Katsina religion, Southwestern Cult) (Adams 1991; Beck 2001; Crown 1994).

Table 7.6. Archaeological Evidence for *He-we* and *Piki* Stones.

Region/Area	Site	Dates (A.D.)	No. rooms excavated	No. of *Piki*/*He-we* fragments recovered	Reference
Middle Little Colorado	Homol'ovi IV	1260-1285	10	13	Adams 2002; Dedecker 2005
	Homol'ovi III	1285-1375	20	9	Adams 2002; Dedecker 2005
	Homol'ovi I	1290-1390	70	61	Adams 2002; Dedecker 2005
	Chevlon Ruin	1285-1390	39	37	Adams 2002; Dedecker 2005
	Homol'ovi II	1350-1400	34	12	Adams 2002; Dedecker 2005
First Mesa	Walpi	1600+	140	116	Adams and Greenwald 1979:23,25
Upper Little Colorado	Hooper Ranch	1275-1350	21	1	Field Museum Notes
	Rattlesnake Point	1325-1400	31	6	ULCPP Notes
Puerco West	Puerco Ruin	1250-1380	29	6	Barton 1990
El Morro Valley	Pueblo de los Muertos	1275-1325	17	2	CARP Notes
Central Zuni	Heshot uła	1325-1375	4	1	HARP Notes
	Middle Village	1350-1400	5+	2	Gebauer 2003
	Middle Village	1400-1525	5+	2	Gebauer 2003
	Hawikku	1400-1680	370	7+	Smith et al. 1966
	Middle Village	1525-1900	5+	51	Gebauer 2003

While *he-we* slabs were manufactured by men, they were seasoned, used, and maintained as prized possessions by women at Zuni (Allen 1995:29-30; Cushing 1920:321-331; Edaakie 1999:8; Stevenson 1904:361-363). Seasoning *he-we* slabs involved extensive heating and the application of an oil made with masticated squash seeds and, "a pound or more of raw pinyon gum," that was rubbed on the slabs with sticks (Stevenson 1904:262). This seasoning is what gives fragments of flatbread griddles a distinctive blackened color and oily texture. The earliest evidence for maize flatbreads in the northern U.S. Southwest comes from Homol'ovi settlements in the Middle Little Colorado region in the mid-13th century (Table 7.6). In the Cibola region, the Upper Little Colorado area provides some of the earliest evidence for practice of the Katsina-like religious practices as well as for the incorporation of migrant populations (Duff 2004:82). As such it is likely that this area was particularly important in terms of the innovation and/or early adoption and teaching of flatbread cooking techniques in the Cibola region. This is supported by the recovery of flatbread griddle fragments from the Pueblo IV period Hooper Ranch and Rattlesnake Point sites (Table 7.6).

Results from this study (Table 7.6) suggest that flatbread production was introduced into the Cibola region in the late 13th or early 14th century, roughly a century earlier than has previously been recognized (ca. A.D. 1400). Dramatic differences in the extent of excavation in Pueblo IV period sites between the Middle Little Colorado and Cibola regions (especially the Central Zuni area) make comparing trajectories in early flatbread production difficult (Table 7.6). Available evidence suggests that flatbreads were produced earlier and more intensely in the Middle Little Colorado and Hopi Mesa areas than in the Cibola region. Flatbread production in the Cibola region also never became as formalized in terms of construction of distinctive clan or lineage *piki* houses and the three-sided hearths that are recorded in the Middle Little Colorado and Hopi Mesas after A.D. 1350 (Dedecker 2005).

By the time of the Spanish *entrada* laboriously prepared maize flatbreads had become a staple of daily meals in addition to valued foods exchanged and provisioned for ceremonial and social public feasting events at Zuni. While it took several hundred years before special *he-we* flatbreads were considered daily fare, evidence for this change in cuisine in the Pueblo IV period is remarkable in terms of the labor and knowledge involved in both producing the griddles and the complicated recipe and cooking technique used to make *he-we*. The ability to produce and/or prepare flatbreads likely would have been ascribed special prestige and made these foods an important and powerful inclusion in ceremonial activities and public commensal events in plazas.

Chapter Summary

Distinctions in cuisine made in previous chapters are supported by available evidence for cooking activities and techniques across Cibola settlement areas. Cooking practices appear to have been organized somewhat differently in northern and southern Cibola settlement areas, and cooking in the Central Zuni area often involved parching and toasting techniques and the use of tomatillo as a signature flavoring agent. Settlements in the Upper Little Colorado provide some evidence for the mixing of cuisines in the Pueblo IV period, something likely tied to the incorporation of migrants and the maintenance of extensive extra-regional social ties. I suggest this unique social environment and increasing participation in integrative ritual practices and ideologies played an important role in the innovation and/or early adoption of specialized maize flatbreads in this area.

Maize flatbreads were also produced to some degree in the Central Zuni and El Morro Valley areas in the Pueblo IV period, although limited available excavation data make it difficult to compare the early preparation of flatbreads in these areas with more western portions of the Cibola regions.

At the regional scale, both artiodactyls and turkeys were being cooked at settlements in the 13th and 14th centuries, and available evidence indicates these foods were often served at special communal commensal events. As with patterns of food storage discussed in Chapter 6, there is little evidence for changes in the organization of cooking activities in the Cibola region over the Pueblo III and IV periods. Patterns in cooking jar volume provide some evidence for household-based cooking at supra-household scales, something that appears to have been especially common in the El Morro Valley. In the following chapter I examine evidence for food consumption and further explore the links between communal feasts and changes in cuisine and the scales of food production, preparation, and cooking documented thus far.

Chapter 7 Notes

[1] As rectangular slab-lined hearths were constructed in the northern Cibola and sometimes in the Upper Little Colorado from the Pueblo II period onwards, the presence or dominance of rectangular slab-lined hearth types in the Cibola region cannot alone be used to argue for increases in the intensity of maize agriculture and changes in cuisine involving boiling or stewing maize (Lowell 1999) or the baking of maize flatbreads on griddles (Snow 1990). While rectangular slab-lined hearths do have some important functional attributes, I suggest their presence primarily reflects learned architectural traditions in the Cibola region (see also Peeples 2018).

[2] While limited, turkey remains exhibit both butchering and burning marks at two Pueblo II period Chacoan outlier sites, H-Spear site in the Central Zuni area (OBAP 2006) and Cox Ranch in the Mariana Mesa area (Mueller 2006).

[3] The original submitted report for burning on faunal remains from Heshot uła likely flipped burned and unburned codes, as burning rates are reported as 86% for turkeys and 85% for artiodactyls respectively. I have interpreted it as 14% and 15% as this is far more reasonable given the depositional context of the remains (i.e., trash filled rooms and midden deposits).

[4] For most samples recovered and analyzed as part of the CARP project, recovered maize parts were not specified. Other floatation analyses from sites in the El Morro Valley (e.g., Howell 2004; Oas 2016b; Raily 2008) suggest kernel recovery rates in hearths are comparable to those reported in the Central Zuni area.

[5] While very uncommon (n=23), evidence for the smudging of jars was equally split between Cibola Gray Ware and Mogollon Brown Ware jars, across settlement areas, and over time (Appendix E.1).

[6] Rudd Creek Pueblo was likely a major ceramic producer in the Upper Little Colorado in the Pueblo III period. This may explain in part why decorated and undecorated jars, as well as ladles and bowls from this settlement are consistently larger on average than ceramic vessels analyzed from most other sites in this study.

Chapter 8:

A FEAST OF MEAT, A DAY OF SOCIABILITY; SERVING, CONSUMING, AND DISCARD

"*A feast of meat, a day of sociability…make helpfulness a pleasure rather than a tedious burden* (Bunzel 1938:353-354)."

While the previous chapters have focused on the work of making meals, in this chapter I consider evidence for food as it is served and consumed. The act of eating builds and sustains the human body; meals, especially when shared with others, play an important role in strengthening social and political relationships and in communicating information about social identities and ideologies (Chapter 2). To understand how foodways factor into and are influenced by processes social change, it is important to consider the similarities and differences in the social dynamics and symbolic ties between daily meals and special commensal events. In the northern U.S. Southwest, previous work indicates that largely identical foods and serving equipment were used in household meals and communal feasts (e.g., Potter and Ortman 2004; Van Keuren 2004). This emphasis on the performance of intimate, domestic meals at communal commensal events suggests that feasting in U.S. Southwest was generally less extravagant, competitive, and as openly political as has been recorded for many other smaller-scale societies (e.g., Dietler and Hayden 2001a; Potter 2000; Wills and Crown 2004). Further, the mirroring of the household in the large commensal event is thought to have facilitated social integration and reinforced collective, communal ideologies (Potter and Ortman 2004). Despite massive increases as the size of settlements and public architectural spaces over the 13^{th} and 14^{th} centuries (Chapter 3), I expect that the foods and foodcrafts featured in household meals and ceremonial feasts remained largely similar across the Cibola region during this period.

As special commensal events are an important nexus of communal social and political life, it is also important to examine trajectories in the scale and performance of commensal events and to address the socioeconomic and political dynamics of financing these events (Dietler and Hayden 2001b; Potter 2000; Mills 2007a; Pollock 2012; Spielmann 2002). Feasting is costly in terms of time, labor, and resources. As such, evidence for the hosting and financing of feasts can be seen at some level as a "performance of abundance" (Varien et al. 2017:68). Beyond the actual event where foods are served and consumed, feasts involve immense amounts (sometimes years) of planning and coordination between the various individuals and households producing, preparing, cooking, and serving food for these events. In small-scale societies, the celebration of communal ritual feasts is frequently associated with a degree of economic intensification and craft specialization (Spielmann 2002). Given previously discussed evidence for increases in the scale and intensity of food production (Chapter 5), preparation (Chapter 6) and cooking (Chapter 7), I expect that these changes in foodways were often linked to increases in the scale or frequency of ritual events and supra-household food consumption across the Cibola region in the late 13th century.

I begin this chapter with a discussion of ethnographic accounts of daily and special commensal meals at Zuni. I then draw on previous archaeological studies of daily food consumption and feasting in the Cibola region and northern U.S. Southwest and data on ceramic bowl size to address how the nature of domestic meals as well as the scale and dynamics of communal commensal events changed over the 13th and 14th centuries in the Cibola region.

Ethnographic Accounts of Meals at Zuni

The ethnographic record provides some sense of what daily meals and special commensal events might have been like in the Cibola region in prehispanic periods. Specifically, these accounts provide information about the frequency and timing of meals throughout the year, as well as the range of participants, typical menus, spatial settings, utensils, etiquette, and other performative dynamics of serving and consuming food. These aspects, while challenging to directly address archaeologically, are at the crux of understanding the social event, performance, power, and cost of the meals in the past.

Ethnographic accounts suggest that food serving activities at Zuni, either involving the laying out of meals at home or delivering food to those working in fields, were always associated with women and girls (Cushing 1920:275, 406, 467, 582). Historically, men also took part in serving (and cooking) food at sheep camps or while out hunting or on other longer journeys (Cushing 1920:584-600). In a domestic setting, this gave women a great deal of power and control over the timing and distribution of food (Cushing 1920:569-575). The redistribution of food to spectators at large hosted dances and/or other ceremonials in plazas was often done by masked (male) participants, although the initial provisioning of large bowls of stew and baskets of bread by women for these events would have been seen by gathered spectators (Stevenson 1904:137,197, 226, 274). Women would also have been seen handing down bowls and baskets of food for feasts consumed in kivas, although they might not as often have shared in the consumption of these meals (Stevenson 1904:222-223, 249). Finally, women also "fed" ceramic vessels, particularly cooking jars, with fragments of *he*-we before firing (Cushing 1920:313-315; Stevenson 1904:376).

Historically, daily meals were consumed by household groups and visitors seated on the ground around a central bowl of stew with side baskets of *he-we* bread and an assortment of condiments like salt, powdered or fresh chiles, and various seasonal sauces (Table 8.1). Consuming a household meal might involve each participant dipping fingers into the bowl, using portions of bread, jerky, peppers, or shared ceramic or gourd ladles (Cushing 1920:284, 551-579; Stevenson 1904:369). There was a learned skill in eating different foods out of hot bowls and an etiquette surrounding the sharing of a ladle. Cushing himself in one of his first household dining experiences kept the ladle for himself for the entire meal, much to the confusion and eventual amusement of his hosts (1920:555).

Table 8.1. Ethnographic Examples of Daily and Special Commensal Meals at Zuni.

Commensal Occasion	Number of Bowls	Foods Served	Reference
Daily meal consumed at home (or with guests)	1	Bean stew, baskets of bread, condiments of salt, peppers, seasonal sauces, small game	Cushing 1920:549, 561
Agricultural work parties	10-12	Meat stew with chiles, *he-we* of multiple colors	Cushing 1920:203
Parties of women grinding corn for ceremonial events	up to 16	Meat stew and baskets of bread	Stevenson 1904:240, 592
Feasts served by women for kiva ceremonials	56	Meat stew, multiple varieties of bread, stewed peaches, watermelon	Stevenson 1904:249
Dances in Plazas	75	Meat stew, baskets of bread, watermelon, peaches, ears of corn, deer, antelope, small game	Stevenson 1904:197, 274-276

Seasonal variations in the timing and content of meals are also documented. Cushing (1920:563-564) notes that breakfasts in the winter were more leisurely affairs, while the work of farming in the summer delayed the first meal of the day until close to noon. For both smaller-scale feasts, like those consumed by supra-household agricultural work parties on roofs, or in the case of ritual feasts consumed in kivas or plazas, the menu often featured bowls of spicy meat stew, trays mounded high with *he-we* made in all six colors (i.e., red, yellow, blue, white, purple, mixed) as well as other specially prepared breads, tamales, dumplings, and sweetened cakes and puddings (Cushing 1920:203, 556-560) (Table 8.1). The most distinctive, elaborate, and extensively prepared and shared meals are associated with the *Sha*'*lak*'*o* feasts in early winter (Stevenson 1904:238).

While large (>30 liter) cooking jars were likely used primarily to provide food for communal feasts in plazas in prehispanic periods (Chapter 7), it is also important to consider the range of supra-household meals that could also have necessitated cooking at supra-household scales (Potter 2000). At the Pueblo of Zuni historically, supra-household meals involved everything from regular gestures of hospitality extended to local and distant visitors (Cushing 1920:275, 526-549), rewarding agricultural or maize grinding work-parties with a home-cooked feast (Cushing 1920:203, 366; Stevenson 1904:240, 350-352), and cooking and baking vast quantities of food to participate in or fund a range of social events and communal ceremonial feasts (Cushing 1920:556-559, 607-613: Edaakie 1999:4, 25; Zuni People 1972:20-21; Stevenson 1905:104, 114, 159, 222-229, 364) (Table 8.1). Given evidence for agricultural intensification, especially in the Pueblo IV period (Chapter 5), I expect that larger groups of families in nucleated pueblos regularly worked together to prepare, plant, and tend fields, and that these groups would often share meals in informal architectural spaces, such as rooftops, in the summer months.

Daily Meals and Feasts A.D. 1150-1400

Direct evidence for food consumption is limited in the northern U.S. Southwest in the Pueblo III and IV periods. Isotopic analyses, while geographically restricted, indicate that maize frequently constituted an extraordinary 70-90% of the diets of individuals living in the 13th and early 14th centuries (e.g., Coltrain and Leavitt 2002; Ezzo 1993; Kellner et al. 2010; Matson 2016). A large study of coprolites from Antelope House in Canyon de Chelly dating ca. A.D. 900-1250 provides a unique view into the kinds of daily and special seasonal meals that were served and consumed by individuals in in the Pueblo II to Pueblo III periods (Sutton and Reinhard 1995). Remains of maize were recovered from the majority of coprolites, and in two nearly mutually exclusive states: as whole kernels and as ground or milled maize remains (1995: 746). Whole kernels were associated with beans and bone fragments and interpreted as the consumption of special post-harvest stews. Coprolites containing milled kernels were interpreted as the consumption of dried maize stores. The frequent co-occurrence of milled maize flour with amaranth and goosefoot provides direct evidence for the common prehispanic practice of mixing and enriching maize flours with other ground seeds (Chapter 5). Additional foods recorded in the Antelope House coprolite study include: beeweed, groundcherry, pinyon, prickly pear, purslane, ricegrass, sumac, and yucca. This now familiar list of plant taxa highlights the deep history and widespread use of numerous agrestal and wild economic plant foods to flavor and enrich the nutrition of staple maize dishes year-round.

The Performance of Household and Supra-Household Consumption A.D. 1150-1400

Data on public architecture and the designs on ceramic serving bowls provide important insights into the scale and social diversity of communal commensal events in aggregated villages and nucleated towns the Pueblo III and IV periods. These data can also be used to make inferences about the performance of supra-household meals and what kinds of social messages were being communicated in different contexts (e.g., Mills 2007a; Spielmann 2004; Van Keuren 2004). In the Pueblo III and IV periods supra-household meals would most likely have been consumed in a range of public architectural spaces, including roofed and unroofed great kivas, courtyards, and plazas (Chapter 3). The dynamics of serving and/or consuming meals in kivas would be vastly different than in unroofed great kivas and later plazas, as larger architectural spaces allow for larger numbers of participants and spectators and alter the experience of many sensory aspects of meals and performances, including lighting, visibility, smell, taste, and sound (Dungan and Peeples 2018; Mills 2007a). While there is less direct evidence for the kinds of foods being served at feasts, ethnographic accounts and previous studies of faunal remains suggest that the consumption of large quantities of meat, typically deer, antelope, or turkeys, was often a part of feasting in the Cibola region[1] (Dean 2001; Potter 1997a, 1997b, Potter 2000).

The performance of serving and consuming meals at household and supra-household scales is linked to the meanings and values associated with different foods and vessels they are served in. Meals at any scale are dynamic social arenas where different cultural histories, social identities, personal relationships, and ideologies may be emphasized, masked or even contested. These dynamics or "gastro-politics" operate constantly at daily meals and take on additional significance, meaning, and memorability at larger-scale commensal events (Chapter 2). In the Cibola region, red ware bowls were commonly used to serve food at both daily household meals and special supra-household commensal events. The use of red ware serving bowls across the Cibola region and elsewhere in the 13th and 14th centuries likely expressed a shared participation in longstanding traditions of feasting in the U.S. Southwest (e.g., Blinman 1989; Spielmann 2004; Van Keuren 2004), and also emphasized symbolic connections both between daily household and communal meals (Potter and Ortman 2004) and sometimes associations with the particular places where bowls were manufactured (Spielmann 2002, 2004). In addition to expressing shared histories, social and ideological messages were also conveyed through the use of different designs on the exteriors of bowls and sometimes the slips and designs on the interiors of bowls (e.g., Eckert 2012; Mills 2007a; Peeples 2018). The intentional use of bowls to convey social messages at supra-household feasts is supported by several analyses of design visibility and height on decorated bowls exteriors that indicate these visual properties shifted over time in relation to the nature and size of the public architectural spaces in which they were being used (Mills 2007a; Peeples 2018).

In the 13th century, red-slipped St. Johns Polychrome bowls with large, distinctive exterior decorations were one of the most widely produced and exchanged goods across the Cibola region and beyond (Peeples 2018). The exchange of decorated bowls and other ceramics likely took place at public ceremonial events that involved feasting (Potter

2000). St. John's Polychrome bowls were intensively produced in at least parts of each of the core settlement areas considered in this study (Duff 2002; Peeples 2018), although the Upper Little Colorado was somewhat disconnected from networks of ceramic vessel circulation with the rest of the Cibola region in the Pueblo III period (Peeples 2018). St. John's Polychrome bowls with prominent continuous exterior designs mark a departure from earlier White Mountain Red Ware bowl decoration traditions. The practice of decorating red ware bowls with large exterior designs parallels increases in the scale and inclusivity of public architecture at post-Chacoan settlements in the Cibola region (Chapter 3). Increases in the size of public architectural spaces and the visibility of exterior designs on decorated red ware bowls support arguments that the social scale of supra-household feasting also increased across the Cibola region over the 13th and 14th centuries.

With the transition to nucleated pueblos, previously used matte paints were replaced by several glaze recipes across the Cibola region (Huntley 2008). This rapid ceramic technological shift is associated with changes in painted vessel design, the construction of large plazas, and an increasingly strong north-south division in the circulation and exchange of decorated ceramic bowls (Peeples 2018). In the Pueblo IV period, Zuni Glaze Ware vessels, including Heshotauthla Black-on-red, Heshotauthla Polychrome, and Kwakina Polychrome types, were largely produced in the Central Zuni and El Morro Valley areas. In contrast, late White Mountain Red Wares, including Pinedale Black-on-red, Pinedale Polychrome, and Fourmile Polychrome types, were largely produced in more southern Cibola areas (Carlson 1970; Huntley 2008; Peeples 2018).

The dominance of Zuni Glaze Ware bowls in the Central Zuni and El Morro Valley areas, and limited evidence for the import of other decorated bowl traditions, suggest a greater degree of emphasis on communicating shared as opposed to diverse social identities in these areas (Hegmon et al. 2016). Increases in the scale and inclusivity of public architecture, the emphasis on crafting visually similar ceramic vessels, and a decrease in interaction and exchange within and outside the Cibola region, are each linked to important changes in the expression of shared categorical identities in the Central Zuni and El Morro Valley in the Pueblo IV period (Peeples 2018). Supra-household feasting activities in these areas may have discouraged experimentation in the production and use of different foodcrafts or foods, at least in public settings.

In contrast with northern Cibola settlement areas, Zuni Glaze Ware, late White Mountain Red Ware, and Roosevelt Red Ware vessels were both locally produced and imported in more northern and central portions of the Upper Little Colorado area in the late Pueblo IV period ca. A.D. 1325-1400 (Duff 2002). Hopi Yellow Ware vessels were imported into the Upper Little Colorado area from the Hopi Mesas in northern Arizona. This diversity in decorated ceramic bowl production and consumption in the Upper Little Colorado indicates the maintenance of diverse social ties and suggests that supra-household feasts were socially and visually diverse events. Exterior designs on Roosevelt Red Ware and many types of late White Mountain Red Ware serving vessels, are different from both earlier design traditions and contemporaneous Zuni Glaze Ware bowls produced in the north. Specifically, designs often feature discontinuous large, single motifs, and even early examples of Katsina imagery[2] (Adams 1991, Crown 1994; Martin et al. 1961). While Pueblo IV period settlements and their public architectural spaces were smaller in the Upper Little Colorado area than those in the north (Chapter 3), the diversity of decorated serving bowls being used, evidence for "hybridity" in public architectural spaces (see Dungan and Peeples 2018), as well as evidence for the production of special maize flatbreads (Chapter 7), mark settlements in the Upper Little Colorado area as especially dynamic arenas for commensal activities, something that likely encouraged innovation and experimentation in cuisine in the Pueblo IV period.

Serving and Consuming in the Cibola Region

In this section, to examine changes in commensal practices at a somewhat finer spatial scale and address relationships between increases in the scale of commensal activities and craft specialization, I draw on data on ceramic bowl orifice diameter and compare them with previous studies of decorated bowl size. There is an established history of research in the US Southwest that relates the relative sizes decorated bowls to the size of groups consuming from them. However, relationships between vessel size and consumption group size are complex (see Mills 1999; Wills and Crown 2004). A number of factors can influence vessel size, including changes in food preparation techniques and preferences (e.g., Mills 1999, 2008), the scheduling of meals (Crown 2000); household size (e.g., Turner and Lofgren 1966), the wealth and status of households (e.g., Nelson 1981), and has most often been argued, increasing participation in communal feasts (e.g., Eckert 2012; Graves and Eckert 1998; Ortman and Bradley 2002; Spielmann 1998; Van Keuren 2004; Varien et al. 2017).

When bowl diameters from the core Cibola settlement areas are compared across all wares and types, bowl diameters vary widely (10-40 cm) in size, although most bowls fall into the 20-30 cm range (Fig. 8.1; Table 8.2). As discussed previously, some of the observed variation in bowl size, likely reflects the use of bowls to temporarily store, mix, and process ingredients and, in the case of Mogollon Brown Ware bowls, to cook or reheat foods (Chapter 7). In terms of supra-household serving and consumption, if public commensal activities increased in scale and/or frequency I expect a similar increase in the size of some decorated serving containers, as was the case with ceramic cooking jars (Chapter 7). Specifically, I expect changes in the distribution of bowl sizes that reflect the crafting of both small bowls for daily household consumption needs and large decorated serving bowls intended to transport, serve, and/or consume foods at supra-household events.

Table 8.2. Statistical Summary of Ceramic Bowls by Site.

Sub-Region	Period	Site	Sample (n)	Min-Max (cm)	Mean Diameter (cm)	SD	CV
CEN	PIII	Hinkson	121	14-38	26.9	4.9	0.18
CEN	PIII	Jaralosa	20	20-38	26	4.9	0.19
CEN	PIII	NA 11,527	42	18-36	26.6	5.6	0.21
CEN	PIII	NA 11,530	64	20-40	28.1	5.2	0.19
CEN	PIV	Heshot uła	82	20-38	26.2	4.7	0.18
CEN	PIV	Lower Pescado	121	16-32	27.2	4.5	0.17
EMV	PIII	LA 132353	22	16-38	28.5	5.6	0.20
EMV	PIII	Los Gigantes	56	20-40	26.9	4.4	0.16
EMV	PIII	Pettit	234	20-40	28.1	4.3	0.15
EMV	PIII	Scribe S	66	12-42	27.4	6.8	0.25
EMV	PIII	Tinaja	82	20-40	26.5	4.2	0.16
EMV	PIV	Atsinna	119	14-42	26.2	4.3	0.16
EMV	PIV	Mirabal	353	12-42	27.8	5.7	0.21
EMV	PIV	Pueblo de los Muertos	431	12-40	27.2	5	0.18
ULC	PIII	Coyote Creek	289	14-40	27.4	5.4	0.20
ULC	PIII	Rim Valley	33	16-36	25.2	4.2	0.17
ULC	PIII	Rudd Creek	123	10-42	27.7	5.8	0.21
ULC	PIV	Baca	32	14-34	24.4	4.3	0.18
ULC	PIV	Casa Malpais	196	14-38	27.3	4.5	0.16
ULC	PIV	Hooper Ranch	372	12-38	26.3	4.6	0.17
ULC	PIV	Rattlesnake	213	18-38	27.2	4.6	0.17
ULC	PIV	Table Rock	195	14-36	27.1	4.5	0.17

In the northern U.S. Southwest, and especially the Rio Grande region, bimodal distributions in the size of decorated bowls have often been associated with increases in communal feasting, craft specialization, and exchange (e.g., Eckert 2012; Graves and

Eckert 1998; Mills 1999; Spielmann 1998, 2002, 2004; Van Keuren 2004). In many studies of decorated bowls size, smaller bowls are associated with regular household consumption needs[3] while larger decorated bowls are interpreted as serving vessels that would be used to serve food to supra-household groups. Suggested modes or size classes of bowls in the Salinas and other Rio Grande areas in the Pueblo III and IV periods include a smaller mode of decorated bowls with diameters around 18-20 cm in diameter and a larger mode measuring 28-30 cm or larger. In the Cibola region, Van Keuren (2004) analyzed a large collection of complete bowls, and suggested two size modes for St. John's Polychrome bowls in the Pueblo III period, with diameters of smaller bowls falling in the 22-24 cm range and larger bowls in the 28-30 cm range. Eckert (2012) also noted that both Heshotauthla and Kwakina Polychrome types of Zuni Glaze Ware from Pueblo IV period sites in the Central Zuni and El Morro areas were on average larger than 24 cm in diameter. Altogether, these studies suggest that large decorated bowls with mean diameters upwards of 30 cm may often have been used to serve food at supra-household scales.

Each of the core settlement areas examined in this study were producers of red ware bowls in the Pueblo III and IV periods (Duff 2002; Peeples 2018; Schachner et al. 2011), and at nearly every site the majority of recorded and analyzed bowls were early White Mountain Redware or Zuni Glaze Ware. Pueblo IV period settlements in the Upper Little Colorado area have a greater diversity of decorated bowls, including Hopi Yellow Ware, or Jeddito Yellow Ware, and Roosevelt Red Ware, also called Salado Polychrome (Fig. 8.1) As with Hopi Yellow Ware, Roosevelt Red Ware vessels were not recovered from settlements in the Central Zuni and El Morro Valley in the periods examined here.

Ceramic bowl size data support arguments that red ware bowls were the preferred serving vessels at both daily meals and feasts, with mean diameters of about 28 cm (Figure 8.1, Table 8.2). On average, Cibola White Wares as well as undecorated Cibola Gray Ware bowls and Mogollon Brown Ware bowls are smaller than their red ware counterparts. These results are consonant with other studies comparing mean bowl diameters between various contemporaneous red and white ware bowls (e.g., Mills 2007a; Spielmann 1998). Mean bowl diameters of Hopi Yellow Ware are also smaller on average than red wares (Fig. 8.1). The crafting of some large (>30 cm) Cibola White Ware, Hopi Yellow Ware, and Mogollon Brown Ware bowls does raise questions about where and how these bowls may have been used, particularly whether they may also have been used at times to serve food in supra-household contexts.

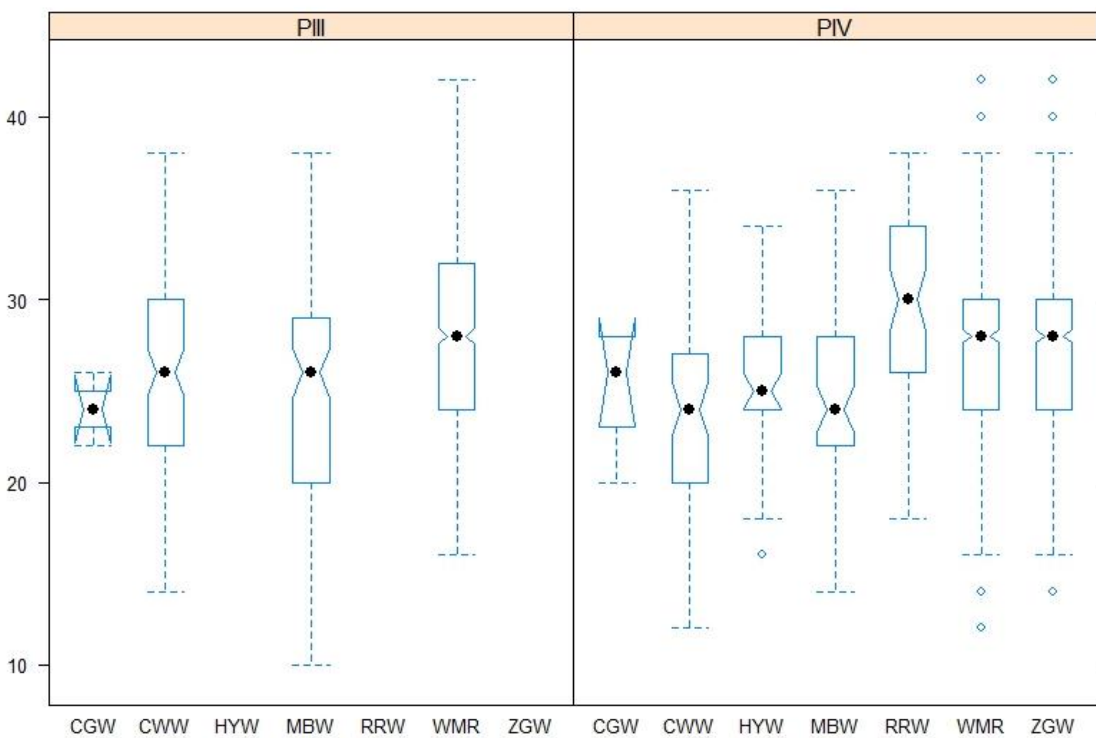

Figure 8.1. Ceramic Bowl Diameters (cm) by Ware[1] and Period.

[1]CGW-Cibola Gray Ware; CWW-Cibola White Ware; HYW-Hopi Yellow Ware; MBW-Mogollon Brown Ware; RRW-Roosevelt Red Ware; WMR-White Mountain Red Ware; ZGW-Zuni Glaze Ware.

In the Pueblo IV period, the large size of Roosevelt Red Ware bowls stands out (Fig. 8.1), and suggests that the small quantities of Roosevelt Red Ware bowls used in the Upper Little Colorado were specially associated with serving food at feasts as opposed to daily household meals. If Roosevelt Red Ware bowls were primarily used in the context of supra-household meals, this indicates some change in the symbolism and use of serving bowls in the performance of special commensal events. White Mountain Red Ware and Zuni Glaze Ware bowl size distributions suggest they these bowls were used flexibly in both household and supra-household meals, which likely reinforced connections between communal and household meals (Potter and Ortman 2004). The use of special large Roosevelt Red Ware bowls in the Upper Little Colorado may have emphasized other kinds of shared identities, ritual practices, and ideologies within these diverse communities (Duff 2002, 2004).

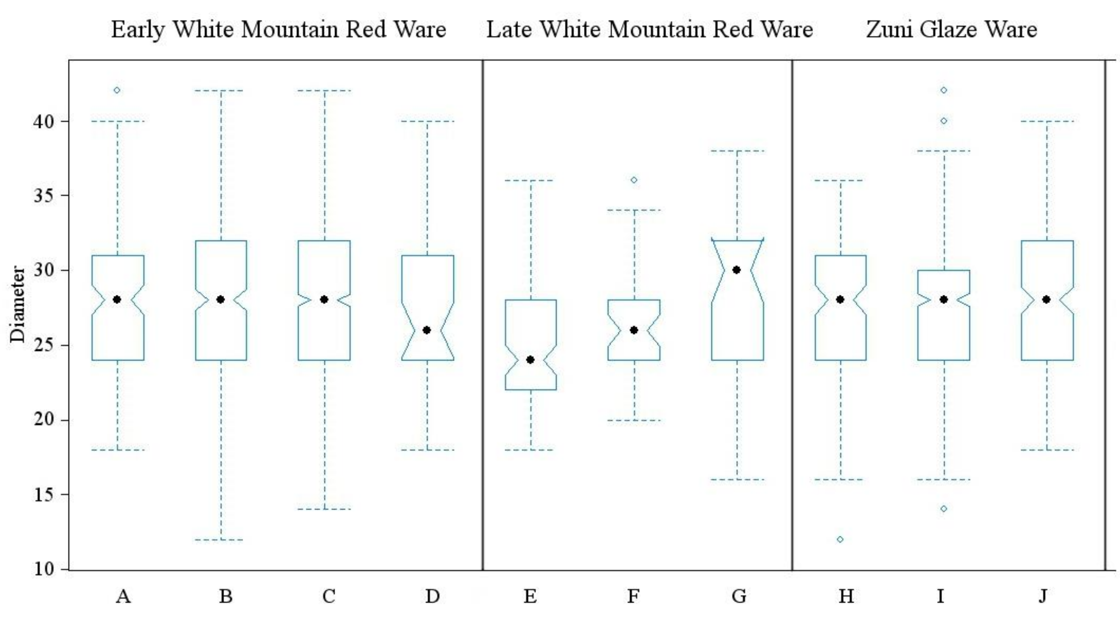

Figure 8.2. White Mountain Red Ware and Zuni Glaze Ware Bowl Diameters (cm) by Type[1].

[1]A-Springerville Polychrome; B-St. Johns B/R; C-St. John's Polychrome; D-Techado Polychrome; E-Fourmile Polychrome; F-Pinedale B/R; G-Pinedale Polychrome; H-Heshotauthla B/R; I-Heshotauthla Polychrome; J-Kwakina Polychrome.

The size of early White Mountain Redware and later Zuni Glaze Ware bowls changes very little even across different bi-chrome and polychrome types. In contrast, in the Upper Little Colorado area Pinedale Polychrome bowls, a type of late White Mountain Red Ware produced somewhat earlier in the late 13th and early 14th centuries, are larger on average than contemporaneous Pinedale Black-on-Red bowls (see also Van Keuren 2004) and noticeably larger than the Fourmile Polychrome bowls produced after A.D. 1325 (Fig, 8.2). The smaller average size of Fourmile Polychrome bowls (Fig. 8.2), compared to earlier Pinedale Polychrome types is interesting, especially given the very large size of contemporaneous Roosevelt Red Ware bowls. Many of the Fourmile bowls in the Upper Little Colorado were likely produced in the Silver Creek area (Triadan 1997), and their appearance alongside locally produced and imported Roosevelt Red Wares and Zuni Glaze Wares suggests very diverse social groups regularly were participants and spectators in Pueblo IV period feasts in the Upper Little Colorado area.

Overall, in the Cibola region decorated red ware (i.e., White Mountain Red Ware, Zuni Glaze Ware, and Roosevelt Red Ware) bowls were larger on average than plain ware bowls or decorated bowls with white or yellow slips in the Pueblo III and IV periods. This supports previous arguments that red ware bowls were primarily used to serve food at supra-household scales. However, evidence for distinct size classes in decorated red ware serving bowls is far more ambiguous and complicated. Figure 8.3 shows the distribution of bowl rim diameters for the two of the most commonly produced and used red ware bowls, St. Johns Polychrome (mainly Pueblo III period) and Heshotauthla Polychrome (mainly Pueblo IV period). For both bowl types, previously suggested size modes of small (22-24 cm) and large (28-30 cm) bowls can be seen strongly overlapping at a regional scale, particularly for St. Johns Polychrome. However, when examined at finer spatial scales patterns in bowl size quickly becomes more complicated. Especially at the level of individual settlements, bowl sizes appear as a diverse range of often unimodal and occasionally bimodal distributions skewing both left and right (Fig.8.3).

These results suggest a great deal of care should be taken in interpreting modes in the distribution of bowl sizes, especially when aggregated to larger spatial scales. As seen in Figure 8.3 when you combine bowl size data from several sites this produces the bimodal distribution seen at the scale of settlement areas. Other patterns however, such as the much higher mode in the size of bowls in the El Morro Valley as opposed to bowls in the Central Zuni and Upper Little Colorado areas in the Pueblo IV period, provide additional support for arguments that the cooking and consumption of food at supra-household scales was particularly common in El Morro Valley communities. Overall, the bowl size data generated in this study suggest a need to revisit arguments made by Van Keuren (2004) concerning the presence of distinct size modes in St. John's Polychrome bowls intended for serving daily versus special supra-household meals in the Pueblo III period. One factor influencing bowl size data in Van Keuren's study is that the whole vessel collections that were analyzed were recovered largely from mortuary contexts in Arizona. In this study, bowl size data was generated from measurements of large bowl sherds sampled from a wide range of archaeological domestic, public architectural, and extramural contexts (Appendix E.3). While more work remains to be done, I argue that modal patterns in Early and Late White Mountain Redwares are more spatially and temporally restricted than has been previously assumed. Furthermore, I suggest that bimodal patterns in ceramic bowls size, especially from whole vessel collections, may often provide more information about burial customs as opposed to evidence for food serving and consumption at supra-households feasts.

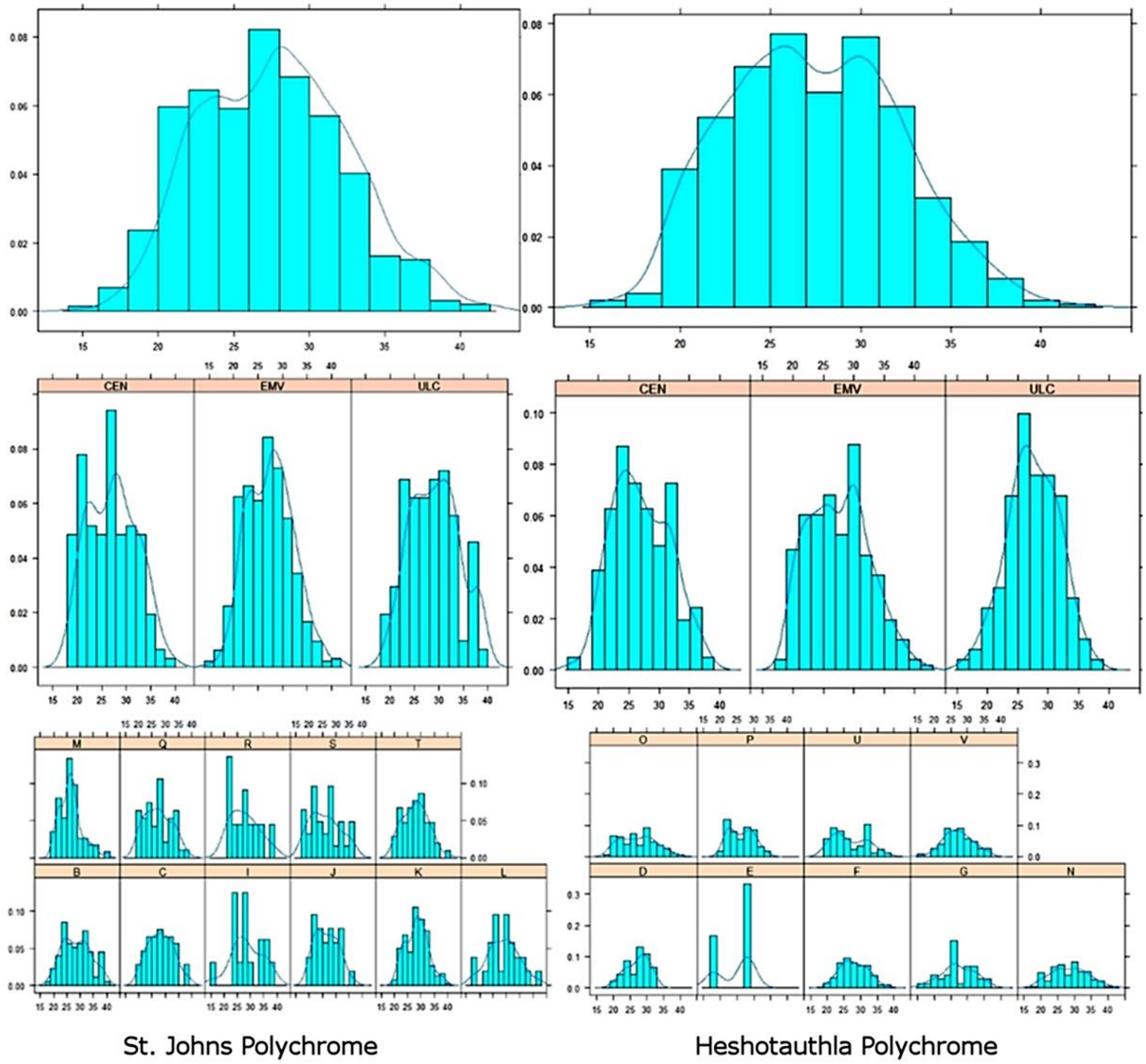

Figure 8.3. Kernel Density Estimates and Histograms of St. Johns Polychrome (n=595) and Heshotauthla Polychrome (n=482) Rim Diameters (cm) at Regional, Sub-Regional, and Individual Settlement Scales.

[1]**Upper Little Colorado (n=265)**: A-Rim Valley, B-Coyote Creek, C-Rudd Creek, D-Rattlesnake Point, E-Baca Pueblo, F-Casa Malpais, G-Hooper Ranch, H-Table Rock; **El Morro Valley (n=569)**: I- LA 132353, J-Los Gigantes, K-Pettit, L-Scribe S, M-Tinaja, N-Mirabal, O-Pueblo de los Muertos, P-Atsinna; **Central Zuni (n=243)**: Q-Hinkson, R-Jaralosa, S-NA 11,527,T-NA 11,530, U- Heshot uła , V-Lower Pescado Village.

One final factor that might contribute to observed differences in decorated bowl size between different Cibola settlements and settlement areas, are differences in specialized ceramic vessel production and transport across the Cibola region. Settlements in the Central Zuni and the El Morro Valley areas were specialized producers and distributers of red wares across the Cibola region. This pattern of almost exclusively local ceramic vessel production and consumption, contrasts with areas like the Upper Little Colorado where individuals produced but also imported many decorated bowls from a range of neighboring and more distant production areas (Duff 2002; Peeples 2018). Vessels intended for transport over long distances might often be made smaller and more portable, and perhaps designed in a way that allowed multiple vessels to nest together. Overall, the amount of variation observed in the sizes of bowls across settlements bowls in the Pueblo III and IV is intriguing, and there remains a great deal more to be done in investigating and interpreting modes and mean sizes of decorated bowls in relation to household and supra-household commensal activities.

Chapter Summary

A range of commensal events in the Cibola region in the 13th and 14th centuries were important contexts for ritual practice, social interaction, and the sharing and exchange of foods and other crafts (e.g., decorated bowls). Decorated ceramic bowls used to serve and consume foods at both household and supra-household meals were carefully designed to convey messages about social identities and ideologies to larger audiences through time. With the establishment of large plaza-oriented towns in the early 14th century commensal activities in northern and southern portions of the Cibola region became increasingly distinct in terms of the decorated ceramic bowls used to serve food at these events. Feasting in the Central Zuni and El Morro Valley areas appears to have increasingly emphasized social solidarity and the expression of distinct collective or categorical identities. In the Upper Little Colorado, the opposite appears to have happened, as the diversity of ceramic wares increased over the 14th century and networks of social interaction and exchange expanded, especially with the incorporation of migrant groups. A mixture of cuisines were likely served and featured at feasts in the Upper Little Colorado, including novel maize flatbreads (Chapter 7). Patterns in bowl size from in this study support previous arguments about the importance of red ware bowl traditions in serving meals to supra-household groups, and several overlapping size classes of White Mountain Red Ware bowls may have been produced to serve household and supra-household consumption needs across the Cibola region. In the Upper Little Colorado area, Roosevelt Red Ware bowls appear to have been produced specifically for use at communal feasts.

Overall, the social scale of public ceremonial activities and commensality increased over the 13th and 14th centuries, especially in massive plazas in the Central Zuni and El Morro Valley areas. The foods and consumed at these large ritual events were supplied by households participating in and financing them. This is supported by evidence for intensification in the production of maize and turkeys, as well as increased procurement of large game like deer and antelope (Chapter 5). Changes in food preparation (Chapter 6) indicate that the scale of grinding intensified to produce more, fine flour that likely was used to make a range of colorful finely processed bread foods for feasts. Ultimately, producing for and participating in large commensal events became an increasingly important and enduring feature of life for households living in aggregated villages and large nucleated towns across the Cibola region in the late 13^{th} and 14^{th} centuries.

Chapter 8 Notes

[1] The distribution of turkey and artiodactyl remains at Rattlesnake Point Pueblo also shows a significantly higher concentration of these taxa in kivas and plazas compared to other rooms or midden contexts. While turkey remains make up a far smaller percentage of the NISP (4%) compared to Pueblo de los Muertos (24%) both settlements suggest that the of raising maize fed turkeys was connected to providing meat for supra-household meals.

[2] There is at least one section of a Pinedale Polychrome bowl with Katsina-like iconography (a mudhead figure) associated with a roomblock kiva at the Pueblo IV Period Pueblo de los Muertos in the El Morro Valley. Interestingly, this was the only site in the El Morro Valley to also have fragments of flatbread griddles.

[3] A slightly different pattern is observed in the Mesa Verde region in the Pueblo III period where “small” bowls likely served individual portions while “large” bowls served household groups (Ortman 2000; Varien et al. 2017).

Chapter 9:

CIBOLA BREADSTUFF

"*The meal and how it is crafted by and crafts the individual, the family, and the group provides access into past social lives and traditions. Studying cuisine's meals and serving utensils not only unveils daily life, family structure, storage patterns, presentation and resource access; it also speaks about economic domains, ideology, and lifestyles* (Hastorf 2016:80)."

In this dissertation I have argued that foodways play a central role in processes of social and political change, and furthermore, that foodways are simultaneously influenced by these social transformations in complex and lasting ways. To examine and better understand this interplay between daily food practices and periods of dramatic social reorganization in the Cibola region, I employed the primary lenses of cuisine and commensality (Chapter 2). By engaging explicitly with these social dimensions of food and comparing trajectories in cuisine and commensal practices at multiple temporal and spatial scales, this study provides new insights into the social drivers and implications of changes in foodways for populations aggregating and coalescing into communities across the Cibola region in the 13th and 14th centuries and in small-scale agricultural societies more generally.

I begin this chapter with a synthetic overview of the different trajectories and social dynamics of Cibola foodways across the Pueblo III and IV periods. Here I compare at multiple scales different histories of cuisine and commensality across the Cibola region through time by drawing together the analyses of food production, preparation, cooking, and consumption presented in Chapters 5-8. Next, I revisit themes introduced in Chapter 2, first discussing how the changes in Cibola foodways presented in this study contribute to understandings of how cuisines develop, persist and change, particularly in small-scale societies. Second, I consider how increases in the scale of food production and consumption activities varied across each of the Cibola case studies and address how these micro-scalar shifts in food practice were linked to broader climatic fluctuations and processes of aggregation and sociopolitical reorganization. Finally, I discuss the methodological contributions of this study, highlighting the value of multi-scalar, synthetic analyses of food for understanding the social and political importance of daily foodways and the diverse ways people have come to relate to and through food in periods of social transformation. I conclude with a brief discussion of future directions for studies of food and social change in the U.S. Southwest and more broadly for smaller-scale societies.

Cibola Foodways and Social Transformations

In the following sub-sections I review major changes in cuisine and commensality across the Cibola region in the Pueblo III and IV periods, drawing together the analyses of different foods, foodcrafts, and food activities presented in the previous chapters. In each section I consider the various temporal and spatial scales at which changes in food practices occurred, and what such developments reveal about different historical trajectories and experience of population aggregation, migration, and settlement reorganization across the Cibola region (Table 9.1). I then discuss the links between changes in cuisine and commensal practice across the Cibola region, and examine how changes in the nature and scale of food production and consumption participated in processes of community formation and changes in the broader political economy of aggregating villages and later nucleated pueblos.

Table 9.1. Trajectories of Cuisine, Commensality, and Social Transformation across the Cibola Region.

Settlement Areas	Social Heterogeneity	Demographic Growth	Pace of Change	Changes in Cuisine	Changes in the Scale of Commensality
Central Zuni	Low	Moderate	Moderate	Modest, linked to shifts in social identification and ritual practice	Increases moderately with population aggregation
El Morro Valley	Moderate	High	Rapid	Modest, linked to shifts in social identification and ritual practice	Increases rapidly and remains high in both periods
Upper Little Colorado	High	Low	Slow	Notable diversity, increases through time, linked the incorporation of migrant populations and new integrative religious practices	Remain modest[1]

[1] Several lines of evidence indicate that communal feasts were held at Rattlesnake Point Pueblo in the Pueblo IV period.

Foodways and Population Aggregation A.D. 1150-1275

The aggregation of Cibola populations into large villages in the early-mid 13th century was associated with fluctuating climatic conditions and a subsequent shift in settlement in many portions of the region to upland areas suitable for dryland farming (Chapter 3). While the use of local gathered signature plants persisted, the diversity of staple crops rose across the Cibola region in the 13th century. This shift in cultivar diversity suggest that Cibola farmers were connected to a broad exchange network of seeds and crop knowledge, a practice that persists at Zuni, and particularly with farmers at Hopi (C. Quam, personal communication, August 23, 2018). Within aggregated villages and settlement clusters, the adoption and experimentation with new crop varieties would have been facilitated and encouraged as larger groups interacted within villages. As the settlements grew in size and the density of farms around settlements increased, Cibola farmers may also have invested more in crops suited for a wider range of soil and moisture conditions. Settlements in the Upper Little Colorado and other more southwestern portions of the Cibola region may have played an important role in these exchanges and in the subsequent spread of new cultivars across the rest of the region (Chapter 5).

While multiple varieties of maize were grown in the Cibola region in the 13th century, farmers and cooks began to produce and prepare larger quantities of flour landraces of maize relative to the flint and pop varieties favored in earlier periods (Chapters 5, 6). Increases in the production of flour types of maize have also been documented in the more northern middle San Juan and Mesa Verde regions in the 12th and 13th centuries (Cutler and Meyer 1965; Doebley and Bohrer 1983). Altogether, this suggests that flour varieties of maize were increasingly valued across large portions of northern U.S. Southwest in the Pueblo III period. If breads and other foods made of maize flour were becoming more socially valued and central to cuisine, floury varieties of maize would have been attractive as the kernels are easier to process into meal. Floury types of maize may also have been preferred over flint and pop varieties because the comparatively higher quantities of fat and sugar in flour kernels lent a more desirable flavor and texture to the dishes made with them (Oas n.d.). Overall, the shift to flour maize and finer ground maize foods appear to have been a critical means by which individuals living in larger villages and towns employed cuisine to participate in communal social life and ritual commensal events.

Evidence for the cooking and increased consumption of domesticated turkeys in the Cibola region is also first widely documented at Pueblo III period villages (Chapters 5, 7). I suggest that this marked changed in Cibola turkey management represents an important shift in the culinary value of turkeys as their role in ceremonial events expanded from primarily being a source of feathers to also being a source of meat. As with the increase noted in the production of flour varieties of maize, intensification in the production of domesticated turkeys has been documented in other portions of the northern U.S. Southwest in the Pueblo III period (e.g., Badenhorst and Driver 2009; Driver 2002). The Cibola case, however, follows a notably different trajectory as turkey production intensified in tandem with increases in artiodactyl hunting (Chapters 5, 7). Thus, decisions by households and communities to increase the amount of labor and maize invested in domesticated turkey production in the Cibola region not motivated as the result of the over-hunting and the resource depression of large-bodied game, as has been proposed for other regions (Badenhorst and Driver 2009; Driver 2002). Instead, increases in the scale of turkey production over much of the Cibola region were most likely socially driven, and as has been previously suggested for communities in the El Morro Valley (Potter 1997b, 2000), linked to the growing needs of households to provide reliable sources of meat for communal ritual feasting activities.

At the scale of settlement clusters, the evidence of changes in Cibola cuisine presented in this study both support and contribute to previous studies of population circulation and social interaction across the Cibola region in the 13th century (Peeples 2018; Schachner et al. 2011; Schachner 2012). Several lines of evidence, including changes in groundstone tool manufacture as well as increasingly distinct food processing and cooking techniques and feature designs (Chapters 6, 7, 8) indicate that decreases in population movement and interaction across the Cibola region over the late 12th and 13th centuries resulted in increasingly distinct cuisine practices in northeastern versus southwestern portions of the Cibola region. I argue these changes in food technologies and techniques were less the outcome of conscious decisions within households to signal or conceal social differences, than the result of gradual shifts in learning networks and the "habituation" (Logan 2012:323) of food practices as Cibola populations became more socially and spatially restricted throughout the 13th century.

Over much of the northern U.S. Southwest, increases in both the relative abundance and size of decorated serving bowls and their decorations, have been used to argue that ritual feasting events became an increasingly important parts of communal social and economic life in villages and plaza-oriented pueblos (e.g., Graves and Spielmann 2000; Mills 1999, 2007a; Potter and Ortman 2004; Spielmann 2002; Varien et al. 2017). At regional and sub-regional scales, however, there was likely considerable local variability in the sociopolitical and economic dynamics of communal commensal events in the 13th and 14th centuries. For the Cibola region, the documented diversity in Pueblo III period settlement layouts and public architecture, especially in the El Morro and Upper Little Colorado areas (Chapter 3), suggest that large commensal events in these spaces may have been similarly diverse and perhaps experimental in structure; thus they would have contrasted with more conservative ritual meals shared in kivas. We might imagine that many aspects of the commensal events held in plazas in the Pueblo IV period, from their economic organization, to their performative dynamics, and even their menus, had their roots in memorable meals hosted in post-Chacoan architectural settings in the 13th century.

Commensal events in the Pueblo III period were smaller in scale than those in the Pueblo IV period in terms of the number of participants and spectators that could be accommodated within public architectural spaces (Dungan and Peeples 2018; Peeples 2018). However, analyses of cooking jar volume indicate that higher proportions of large (>30 liter) cooking jars were often produced and used in aggregated villages as opposed to later nucleated pueblos (Chapter 7). These patterns in cooking jar size suggest that financing large commensal events in aggregated villages often placed greater demands on the preparation and cooking labor and resources of households in the Pueblo III as opposed to Pueblo IV period.

Smaller proportions of large cooking jars at most Pueblo IV period settlements in the Upper Little Colorado and Central Zuni areas may reflect several factors including: (1) a change in the kinds of foods being served at commensal events (e.g., a shift from stews to breads); (2) a decrease in the scale or frequency of large commensal events within settlements and settlement areas; (3) a reduction in the average burden placed on individual households; and/or (4) changes in the social and political dynamics of commensal events that disincentivized or moderated the extent of individual household participation. Overall, these changes in commensality suggest that greater effort was require integrating aggregating groups initially than to maintain it in later periods.

The El Morro Valley provides a slightly different sequence, as significantly higher proportions of large cooking jars were produced in this settlement area in both the Pueblo III and IV periods (Chapter 7). Given similar overall increases in settlement size through time, the marked differences in the proportions of large cooking jars between the Central Zuni and El Morro Valley areas are interesting. In the Cibola region and beyond, some of the very first large nucleated pueblos were established in the El Morro Valley in the 13th century (Schachner 2012). Population aggregation and settlement nucleation in the El Morro Valley was rapid, involved dramatic demographic growth, and the construction of novel settlement forms in a previously uninhabited area (Table 9.1; Chapter 3). These factors likely all contributed to creating a relatively more unstable or fluid social environment in the El Morro Valley compared to the neighboring Central Zuni area which had an occupation history spanning thousands of years and a slower rate of settlement growth (Kintigh et al. 2004). Far higher proportions of large cooking jars at El Morro Valley settlements suggest that supra-household commensal events rapidly emerged and persisted as critical mechanisms for negotiating and maintaining cooperative social relationships within and between newly established communities in this area. I suggest that the unique settlement history and the speed of demographic growth documented in the El Morro Valley played a greater role in increasing scales of commensal activities in this settlement area in the 13th and 14th centuries than increases in settlement size and population density alone.

Settlement Nucleation, Migration, and Foodways A.D. 1275-1400

With the establishment of large plaza-oriented towns in the Pueblo IV period, multiple lines of evidence indicate additional increases in the scale of food production (Chapter 5). Botanical evidence strongly supports arguments for agricultural intensification and expansion around settlements, as well as increases in the cultivation and encouragement of several annual (e.g., amaranth, tomatillo) and perennial (e.g., cholla, yucca) species of plant foods (Chapter 5). Faunal indices indicate that the production of domesticated turkeys and the hunting of artiodactyls continued to increase in the Pueblo IV period (Chapter 5). Thus, with the establishment of large plaza-oriented towns more labor was devoted to meat production and even larger quantities of maize were being grown, in part to expand and maintain these flocks of turkeys. Distinctions in cuisine, especially between more southern and northern settlement areas, became even more pronounced in terms of commensal performance and the diversity of ritual practices and social identities being communicated and reinforced through the serving of foods in public settings (Chapter 8).

As distant migrants were incorporated into settlements in the Upper Little Colorado and as the inhabitants of this area expanded their social networks (Chapter 3), this shift in patterns of interaction and exchange brought together a more diverse array of food knowledge, embodied practices, and preferences into proximity in the late 13th and early 14th centuries. This is supported by several lines of evidence, including increases in the diversity of signature plant and animal ingredients and flavoring agents (Chapters 5, 7), more diverse groundstone manufacture and maintenance practices (Chapter 6), and the manufacture and import of increasingly diverse decorated serving bowls (Duff 2002; Hegmon et al. 2016; Chapter 8). These results support expectations outlined in Chapters 2 and 3 for increases in cuisine diversity in settlement areas where populations became more socially diverse with the incorporation of distant migrants and where levels of representational diversity rose and remained high. Overall, while Pueblo IV period settlements in the Upper Little Colorado area remained comparatively small (i.e., 90-100 rooms), they became both far more socially diverse and these distinctions were manifested materially in their foods and food practices in likely both domestic and more public ritual contexts.

While the results of this study indicate that food production, maize grinding, and supra-household consumption intensified in the late 13th century, the organizational scale of many food activities changed relatively little across the Cibola region through the Pueblo III and IV periods. Available evidence indicates that most food storage, preparation, and cooking activities remained organized at the scale of individual households or possibly extended families (Chapters 6, 7). Some increases in the organizational scale of food production and communal consumption are supported by faunal evidence of the consumption of large amounts of turkey and artiodactyls in plazas, and increases in communal hunting of antelope and rabbits in the Pueblo IV period (Dean 2001; Potter 1997a:180, 2000). In the El Morro Valley, previous studies also suggest some degree of inter-communal resource management was established in the early 14th century, given pronounced differences in local deer versus non-local antelope remains between settlements (Potter 1997a:187).

The other notable shift in the organization of Cibola food activities is the decrease in the social scale of maize grinding in the Pueblo IV period. While there is some variation in this pattern at the regional scale (see Peeples 2018), in each of the core study areas examined in this study, the number of bins in mealing features decreases through time (Chapter 6). This decrease in the number of mealing bins within households has been argued to indicate a shift in the organizational scale of food preparation tasks (i.e., grinding maize) from extended families to primarily nuclear families (Ortman 1998; Peeples 2018). What makes this change in mealing features particularly interesting for the Cibola region is that currently no evidence exists to suggest that decreases in the number of mealing bins in households were offset by shift towards constructing large mealing features in public plaza or rooftop spaces as has been documented at other Pueblo IV period settlements in the northern U.S. Southwest (Ortman 1998). Instead, the construction of single mealing bins in households in each core settlement area examined in this study suggest that nucleated pueblos witnessed both a decrease in the social scale of food preparation and, as I discuss below, an increase in the intensity of maize grinding within individual households in Pueblo IV period.

Across each of the three core study areas, the Pueblo IV period saw not only significant increases in the production of flour varieties of maize (Chapter 5) but also a pronounced change in the manufacture and maintenance of mano and metate technologies (Chapter 6). These changes in food production and preparation suggest that there was a substantial increase in the intensity of maize grinding activities following the establishment of large plaza-oriented pueblos. I argue that these changes in maize production and preparation reflect widespread increases in the social value and labor devoted to preparing finely processed maize flours in nucleated towns. While demands for a range of foods (e.g., tamales, dumplings, cakes) and/or ritual items (e.g., cornmeal) made with finely ground maize flours likely increased in this period, I suggest that some degree of intensification in the production and preparation of fine maize flour was also associated with the adoption of maize flatbreads.

As discussed in Chapter 1, the adoption of this cuisine in the northern U.S. Southwest has been linked to the innovation and spread of integrative, communal ritual practices and ideologies, specifically Kachina cult, across the U.S. Southwest in the Pueblo IV period (Adams 1991:80-82). Within the Cibola region, the results of this study show that fragments of specialized sandstone griddles used to prepare maize flatbreads were most concentrated at Pueblo IV period settlements in the Upper Little Colorado and Western Puerco settlement areas (Chapter 7). While excavations of Pueblo IV period settlements have been far more limited, especially in the Central Zuni area, small numbers of griddle fragments were also recovered from Central Zuni and El Morro Valley settlements. These fragments provide the earliest evidence for flatbread production in these areas and their presence is somewhat surprising given how socially insulated these areas were in the Pueblo IV period (Borck et al. 2015; Peeples 2018). The presence of griddle fragments in these northern Cibola settlement areas speaks to some degree of persistent long-distance interaction, exchange, and/or intermarriage. It is possible these social connections were a factor that contributed to the later migrations into the Central Zuni area in the late Pueblo IV period and following centuries (Kintigh 1985; Peeples 2018, Chapter 3). Overall, this study provides evidence for a degree of flatbread adoption into Cibola cuisines in each of the core settlement areas in the Pueblo IV period, roughly a century earlier than has previously been estimated.

Summary

In summary, several of important changes in Cibola cuisine can be traced to the Pueblo III period and are likely best understood in terms of changes in the scale of commensality and the increasing complexity of political economies in large aggregated villages. Throughout the 13th century households in rapidly expanding settlements devoted more labor to producing and preparing foods for large commensal events. Opportunities to finance, organize, and participate in the serving and consumption of large meals in public settings would likely have been attractive to households as an important mechanism for establishing and negotiating social relationships within rapidly expanding and somewhat unstable social communities. As public commensal events became increasingly central parts of communal life, the months (or more) of planning and work involved would have mobilized labor at large social scales and routinized sustained cooperative endeavors as public ceremonial schedules were established. The performance of ritual feasts in public architectural spaces would also have provided communities with an important means of attracting potential newcomers and a nexus for exchanging and acquiring valued and specialized goods with trading partners. As the size and density of settlements further increased in the late 13th and early 14th centuries, scales of food production and consumption intensified still further, as did the complexity of food preparation and cooking practices as fine flours and flatbreads were adopted and became more valued. I suggest that these changes in cuisine and commensality were central to the increasing importance of participating in communal ritual life and that they played a critical role in processes of community formation.

Continuity and Change: The Practice and Performance of Cuisine

In Chapter 2, I discussed many of the mechanisms and contexts though which new foods are adopted and become central to cuisine. These included a spectrum of "push" factors including changes in food practice due to broader environmental and/or sociopolitical pressures and "pulls" where desires to emulate high status lifestyles or to participate in larger social and ritual life might shape and alter food preferences and cuisine. The Cibola region provides an interesting case to examine trajectories in cuisine as most of the social and ideological factors influencing food practices would have arisen from internal processes of population aggregation and sociopolitical reorganization (Chapter 3).

This study provides insights into a number of processes, social contexts, and tempos though which cuisines changed in the Cibola region through time. In tracing out developments in Cibola foodways from A.D. 900-1400 this research touches on both major regional (often trans-regional) shifts in food practice (e.g., communal feasting, flatbread cuisines, intensified turkey production) and a range of more local trajectories of how different foods and food practices were adopted and reinterpreted with the formation of large villages and social communities. I begin this section on continuity and change in cuisine with a discussion of the foods and food practices that were maintained in households and communities in the Cibola region through the periods of social and climatic instability in the late 13th and early 14th centuries. I then consider some of the mechanisms and social contexts through which cuisine and the social value of certain foods and food activities shifted following aggregation and coalescence.

Continuity in Cuisine

While much of this study has been concerned with understanding how cuisines change, the maintenance of food practices, particularly through periods of upheaval, is an equally interesting social and cultural process. In this sub-section I discuss of the aspects of Cibola foodways that were sustained through periods of both dramatic social transformation and chaotic climatic conditions in the late 12th through 14th centuries (Chapter 3). Across the Cibola region, the overall subsistence economy of sedentary maize agriculture persisted A.D. 900-1400 and continued to thrive at the Pueblo of Zuni well into the 1960s (Cleveland et al. 1995). As climatic conditions fluctuated Cibola farmers moved frequently around the landscape and employed a flexible range of agricultural strategies that included upland dry-farming as well as river and spring-irrigation techniques (Chapter 3).

Many of the staple crops (e.g., Reventador landraces of maize, common beans), gathered plants (e.g., beeweed) and animal foods (e.g., rabbits, deer, domestic turkeys) carefully maintained, procured, and consumed by the inhabitants of the Cibola region represent longstanding culinary traditions shared across most of the U.S. Southwest (e.g. Minnis 1989). While new varieties of maize and beans were adopted and may even have eclipsed earlier varieties in terms of popularity in the 13th century, Cibola farmers maintained earlier crop varieties, indicated by evidence for the storage of morphologically distinct maize piles and popcorn kernels in storage jars in storerooms at Scribe S Pueblo. At more local scales, the inhabitants of different Cibola settlement clusters favored particular gathered and likely often cultivated signature plant ingredients (e.g., manzanita, winged-pigweed) and flavoring agents (e.g., tomatillo) through time. The persistent use of decorated red-slipped serving bowls in the Cibola region also likely represents some degree of adherence and/or reference to longstanding and widespread traditions of commensal performance and symbolism in the northern U.S. Southwest (Potter and Ortman 2004; Spielmann 2004; Van Keuren 2004).

Documenting this degree of persistence in Cibola foodways is an important result of this study. First, it speaks to the enduring success of a subsistence economy based on a mixture of flexible farming strategies, hunting, and plant gathering that, along with high levels of population circulation, sustained Cibola populations through periods of extended climatic instability and dramatic social reorganization (Nelson et al. 2010). In terms of daily household food activities, the consistent use of signature gathered ingredients, flavoring agents, and cooking and food preparation techniques suggests that great value and effort was expended in maintaining and passing down food traditions and knowledge within families. The value placed on maintaining food traditions and the foods of particular places and landscapes is further supported by evidence of distant migrants continuing to obtain and use non-local ingredients and serving equipment after joining settlements in the from the Upper Little Colorado area in the early 14th century. As will be discussed further below, these ingredients and the decorative bowls used to serve them may have been a part of not only household food practice but also featured in socially and ideologically diverse ceremonial meals in plazas and great kivas.

Lastly, results from this study indicate Cibola households and communities in the three core study areas retained access to preferred gathered and hunted food resources throughout the 13th and 14th centuries. Restrictions in resource access and diet breadth are often expected outcomes in periods of social instability and increasing violence and warfare (e.g., VanDerwarker and Wilson 2016). A dramatic reduction in staple grown and gathered plant and animal foods in pre-abandonment contexts at Sand Canyon and Castle Rock Pueblos provides an example of this kind of restriction in access to food in the Mesa Verde region in the late 13th century (Adams et al. 2007). Cibola communities in the three core study areas were very likely aware to some degree of contemporary violence and social unrest in the more southern Mariana Mesa settlement area (e.g., Smith et al. 2009) and in other portions of the northern U.S. Southwest (e.g. Kohler et al. 2014; LeBlanc 1999). However, analyses of foodways in the Central Zuni, El Morro Valley, and Upper Little Colorado areas support previous research (e.g., Schachner 2012: 188-189) in finding limited direct evidence for conflict affecting populations or their foodways in these areas.

Migration, Interaction, and the Practice of Cuisine

In terms of understanding the barriers or pathways that shaped the maintenance, adoption, or restriction of food practices and knowledge across the Cibola region through the 12th-14th centuries, I suggest that different local histories and trajectories of settlement, population mixing, and circulation were important influences on how cuisines developed. Gradual changes in population circulation and networks of interaction (and likely intermarriage) over the 12th and 13th centuries reduced social and economic access to culinary knowledge across the region. While seeds, and other more portable foodcrafts such as bowls continued to be exchanged over long distances (Peeples 2018), changes in the dynamics of regular personal interaction across the region affected how certain techniques (e.g., heating food in bowls) and technologies (e.g., hearth construction, metate manufacture and maintenance) were learned, spread, or became spatially restricted over time. Ultimately, these shifts in learning networks resulted in increasingly distinct cuisine practices in northern and southern portions of the region. Over several generations these changes in cuisine may have been largely unreflexive and not readily observable outside of household kitchens.

In the Central Zuni and El Morro Valley, settlement nucleation involved almost exclusively local groups with similar food preferences and social histories, although it is possible that changes in the size and organization of villages and nucleated pueblos altered the dynamics surrounding how cuisines were shared and taught. Interactions surrounding the preparation and consumption of communal feasts would most likely increase an individual's experience with producing and preparing highly valued foods like turkeys, and perhaps provide exposure to novel foods like flatbreads. As households cooperated to complete different food production and preparation tasks, individuals may have gained access both to a range of ingredients, technologies, and teachers with the knowledge needed to hunt or grow different foods or to create particular recipes.

The adoption and spread of cuisines in the Upper Little Colorado area, where local populations mixed with migrant populations, likely followed a very different course in the late 13th and early 14th centuries. Migrants moving into this area continued to travel or trade for certain non-local ingredients and food crafts, although it is possible that households sometimes overcame restricted access to certain foods by substituting and experimenting with new ingredients and recipes. Experimentation in cuisine, from the use of novel ingredients to the structure of meals themselves, may not have been confined only to domestic contexts. Previous examinations of public architecture (Dungan and Peeples 2018) and of decorative ceramic production and exchange (Duff 2002, 2004; Peeples 2018) in the Upper Little Colorado suggest ritual commensal events in public architectural spaces would have involved a diverse array of participants who felt comfortable in communicate multiple (perhaps competing) social identities and ideologies.

I suggest commensal events in public ritual setting in the Upper Little Colorado may have allowed for a greater degree of experimentation and exposure to diverse cuisines, something that may have eased the adoption of novel cuisines like flatbreads. This finding is consonant with previous observations made by Nelson and colleagues (2011) and others (e.g., Duff 2000; Hegmon et al. 2016) concerning the association of greater social diversity and experimentation with lower population areas of the U.S. Southwest. Flatbreads ultimately became a staple of daily meals and commensal performance at Zuni (Cushing 1920); however, many elements of this process, including the domestic or ritual contexts where flatbreads were first produced and consumed remain uncertain in the Cibola region. While flatbreads may have been highly regarded, there may also have been a degree of initial resistance to this complex new food and its symbolism and history. Ultimately, archaeological studies tracing out innovations in food practice that arise from the mixing and blending of different cuisines should be careful not to overlook the amount of work and experimentation involved and, as with the example of frybread outlined in Chapter 1, how this process is often both tasty and socially contentious (Wilk 2006:108-109).

Innovations in Cuisine, Performance, and Identity

The interplay between changes in Cibola cuisine and communal commensal practice are important for understanding how foodways played a role in the construction of communal ideologies and more bounded social identities in the 13th and 14th centuries. Archaeological and ethnographic records suggest that largely identical foods and foodcrafts were used in household meals and communal feasts in the northern U.S. Southwest, and thus that commensal events would have been less extravagant and explicitly political than feasts with special feasting foods in many other smaller-scale societies (Dietler and Hayden 2001a; Potter 2000; Wills and Crown 2004). Potter and Ortman have argued that, "communal feasts are a metaphorical extension of the domestic meal" (2004:175), meaning that ritual commensal events emphasized and drew their meanings from between domestic, engendered meals. In the Cibola region, the associations between domestic meals and public ceremonial feasts became important ways to communicate social similarities and reinforce communal social identities in aggregated villages and nucleated towns.

Over the 13th and 14th centuries, other aspects of the symbolism and identities expressed through commensal performance grew increasingly spatially distinct and socially distinct across the Cibola region (Peeples 2018). Previous studies suggest that the dynamics of supra-household food meals in the northern Cibola region placed a greater emphasis on social conformity and integration (Hegmon et al. 2016; Peeples 2018). Thus, participants communicated and reinforced a range of similar and complementary identities through their commensal performance in the Central Zuni and El Morro Valley areas, while more diverse, fluid, and competing social identities and ideologies characterized supra-household consumption in the Upper Little Colorado area (Duff 2002; Hegmon et al. 2016; Mills 2007a; Peeples 2018; Potter 2000). Within increasingly socially bounded communities, social and status distinctions along gendered lines were likely also increasingly expressed and reinforced though cuisine and commensal practice (Crown 2000a). I return to this last point further below.

Much of the work on the performance and event of feasting in the U.S. Southwest has focused on a range of practical and "presentational" properties of serving bowls (Van Keuren 2004). These studies have been important for recognizing persistent symbolic connections between the foods and foodcrafts used in communal feasts and daily household meals (Mills 1999; Potter and Ortman 2004; Van Keuren 2004), as well as the use of non-local bowls and "pieces of places" at ritual feasts (Spielmann 2002, 2004). Further, several studies have also highlighted a range of important changes in the commensal practice that appear to particularly characterize feasts in the 13th and 14th centuries including notable increases in the scale and visibility of feasting events (Mills 2007a; Peeples 2018), and changes in cuisine (e.g., flatbreads) and commensality (e.g., feasts in plazas, novel iconography on serving vessels) that have been linked to increased participation in communal ideologies and the adoption of novel religious beliefs (e.g., Adams 1991; Crown 1994; Potter and Ortman 2004; Spielmann 1998; Van Keuren 2004). Another key aspect of commensal performance that is in need of consideration is how the texture and the flavor of foods served in households and public ritual meals persisted or changed in the 13th and 14th centuries, specifically how these sensory aspects of food may have contributed to the construction of communal ideologies and processes of place-making (Sutton 2010).

Flavor is an active, memorable aspect of food that carries symbolic meaning (Adapon 2008; Sutton 2001, 2010). Decisions to recreate familiar dishes or modify flavors and textures in dishes by combining different ingredients or cooking techniques are meaningful actions taken to achieve certain social ends. While challenging to trace out archaeologically, studies that examine similarities and differences in the ingredients and techniques used to prepare different foods and beverages at household and special communal meals (e.g., Crown 2018; VanDerwarker et al. 2007) are promising for understanding how a range of meaningful sensory elements were incorporated into commensal performance in different social settings. In the Cibola region, the use of preferred flavoring agents (e.g., tomatillo) and techniques (e.g., parching) persisted at local levels. The appearance of special stone griddles and an increase in the production of finely processed maize flours, however, suggests there was a widespread change in food texture and flavor preference and practice in Pueblo IV period settlements. Sweet maize foods, including special seasonal dishes made with fresh kernels and roasted green-corn (Cushing 1920: 204-208; Sutton and Reinhard 1995) were likely longstanding features of seasonal commensal events in the Cibola region. In large plaza-oriented pueblos, I suggest that sweet maize dishes took on new, complex forms and significance for women as a range of breads and other dishes made with finely ground maize were incorporated into cuisine and commensal practice throughout the year.

The increasing importance of fine maize flours in Cibola cuisines had important and lasting implications for the lives, labor, and social identities of women living in large nucleated towns. Intensifications in flour preparation took a physical toll on the bodies of women grinding corn at stationary mealing bins for extended periods. In addition, devoting more time to grinding large quantities of finely processed maize likely restructured social interactions between women and the larger community, and may also have introduced scheduling conflicts that impacted a range of domestic activities (Crown 2000c; Ortman 1998). As only singular mealing bins were constructed in the Pueblo IV period settlement areas examined in this study, this suggests that daily grinding activities became more socially isolated through time.

Increased demand for fine processed maize flours likely presented at least some women and their households with new social opportunities and roles, as producers and providers of specialized and highly valued foods and food items (including glazed serving bowls) consumed at ritual events in plazas (Crown 2000c; Huntley 2008). Furthermore, mastering how to prepare specialized foods like flatbreads would likely have provided some women with new ways to increase their social status and prestige and expand their marriage options as they became recognized as skilled cooks and representatives of successful households within their communities. For other women, and especially young adolescent girls, however, these changes in daily food preparation activities outlined in this study, suggest that the changes in foodways experienced by many women may largely have entailed increasing amounts of repetitive, physically demanding labor with little direct social or nutritional benefit.

Summary

The multi-scalar, comparative approach used in this study allowed for an exploration of a range of different social and political contexts and some of the complex mechanisms through which cuisines persisted or changed at varying spatial scales and rates changed in the 13th and 14th centuries. At a local scale, changes in population circulation and later migration influenced trajectories of cuisines in households and communities in a variety of conscious and unconscious ways. Regionally, widespread changes in communal ideologies and ritual practice more overtly shaped cuisine as particular foods and foodcrafts became highly valued parts of supra-household commensal performance. Most changes in Cibola cuisine appear to have been largely endogenous, and there is little evidence that suggests climatic, social (warfare), or other external political pressures strongly influenced cuisine. Instead the development of new social institutions, ritual practices, and diverse communal feasting events were important arenas for culinary of innovation and change. Finely ground maize dishes, flatbreads, and perhaps also turkeys, represent a new chapter in Cibola cuisine, one rooted in processes of population aggregation and nucleation. These regional changes in cuisine were intertwined with increases in the complexity of political economies in large villages and towns and profound changes in the social lives and labor of women.

Commensal Scale and Economic Organization

Understanding the roles and relationships between food and periods of social transformation requires examining contexts of food production, preparation, and consumption and asking not only how the nature of these activities persisted or changed, but in what social, political, and environmental contexts these practices shifted in scale, frequency, or inclusivity over time. One of the questions guiding this research was the degree to which increases in the size and density of social life across the Cibola region also involved changes in the scales of commensality and the kinds of communal ritual feasting previously documented at plazas of several nucleated Pueblo IV period settlements in the Cibola region (e.g., Dean 2001; Mills 2007a; Potter 1997). As participation in communal ritual feasts in small-scale societies usually involves substantial work on the part of households (Spielmann 2002), I also explored what changes in commensality meant for the lives and labor of those involved in producing, preparing, and serving food.

Commensality, Specialization, and the Scale of Food Production

While the most attention has been payed to communal ritual feasts (i.e., Potter 2000) and the importance of communal consumption for social integration and social solidarity, I suggest that less archaeologically visible supra-household food practices played an important part in the process of community formation and in fostering greater cooperation and collaboration. These include shifts in agricultural production and likely the exchanges of labor, foods, and foodcrafts between smaller social groups (e.g., clans, neighbors, kiva groups) within larger emerging social communities. Ritual commensal events in public architectural spaces and work party feasts were crucial mechanisms adopted by groups to integrate, negotiate tensions, and solve or address a range of tensions over leaderships and resource management in rapidly expanding and dense settlements. These arenas of commensal activity facilitated the construction and negotiation of relationships and social identities at larger scales. They also likely established mechanisms for egalitarian social leveling and resource redistribution (Ford 1972; Twiss and Bogaard 2017). They also provided households and the women chances to display their culinary skill and economic success to the larger community and visitors.

Despite stability in the overall subsistence economy (i.e., maize agriculture) and diets of Cibola populations, changes in commensal practice over the 13th and 14th century involved significant increases in the scale and social organization of food production and consumption activities. In other words, while many food practices were maintained through periods of dramatic social reorganization, the size of the social groups and density of the interactions surrounding many food activities increased, as did the labor invested in producing, preparing food for supra-household commensal events. Ritual feasts were likely very attractive to potential settlers and exchange partners (Adams and Duff 2004b; Potter 2000; Spielmann 2002). As larger settlements and social communities were established, this would have increased the amount of available labor and overall efficiency of groups as they expanded and maintained agricultural fields and infrastructure. Finally, not only did the organization and scale of food production and consumption activities increase with aggregation and especially coalescence, but the production and preparation of many foods (e.g. flatbreads) and food crafts (e.g., flatbread griddles, glazed serving bowls) became more specialized.

Previous studies of agricultural intensification associated with population aggregation in the U.S. Southwest (Fish and Fish 2015; Kowalewski 2006, 2013) have interpreted agricultural intensification as a response to several interrelated factors including: (1) in regional and settlement population size and density, specifically with the incorporation of migrant groups; (2) decreasing access to arable land and other food resources as a result of external pressures and/or warfare; and (3) the need to intensify the amount of food being produced in locally accessible arable land and/or extensify specialized food production in more marginal areas as settlement size increased. However, a degree of economic intensification and specialization might also be expected with population aggregation and the establishment of large plaza-oriented towns, based on previous comparative studies of political economic change in coalescent societies (Birch 2013a; Kowalewski 2006) and, more abstractly, the relationships between population interaction density and increases in productivity and economic specialization proposed in urban scaling theory (e.g., Bettencourt et al. 2007; Bettencourt et al. 2014; Ortman and Coffey 2017). Spielmann's concept of the ritual mode of production (2002) provides additional insights into how the importance of ritual participation and performance in small-scale societies powerfully influences the scale of domestic and political economic practices

In the Cibola region, intensification in food production (agriculture, hunting, turkeys) were less clearly tied to dramatic increases in settlement size than changes in the political economy, ritual practice, and the degree of social interconnectedness and efficiency (economies of scale) in larger settlements. Thus, while some shifts in agricultural intensity may have arisen as a response to local population pressure, I suggest that social drivers, including increases in the scale of supra-household commensality, played an important part in the intensification of food production across the Cibola region. In addition, the results of this study suggest that changes in overall size and density (i.e., productive potential and efficiency) of settlements were not enough to explain the differences observed in the levels of food production, preparation, and consumption across the three Cibola cases. The demand for specialized production of foods (i.e., turkeys, rabbits, antelope) and foodcrafts (i.e., large cooking jars) featured in supra-household commensal events in the El Morro Valley far surpassed those in neighboring settlements in the Central Zuni area. This suggests that differences in social dynamics and histories of these two settlement areas played a significant role in increasing and sustaining the larger scale of commensal events in the El Morro Valley. As such, increases in overall settlement size were only one of the factors influencing decisions over how much to produce and invest in communal ritual activities.

Domestic and Political Economies: Cooperation and Autonomy

Increases in the scale of food production, preparation, and commensality documented across the Cibola region suggest some important shifts occurred in terms of household perceptions of surplus and the levels to which households were willing to invest labor and other resources into emerging social and political institutions. Within villages and nucleated pueblos, households likely simultaneously worked to establish stable social communities and strove to preserve a degree of political and economic autonomy. Negotiations over the rules regulating resource access and distribution would have been a constant source of social tension between households and other social groups within settlements. We might imagine that public commensal events were active arenas where these kinds of problems were brought up and discussed. As such, we can view commensal events and the labor invested in them as being central to the work of social integration and coalescence in the Cibola region (Kowalewski 2013).

Despite changes in settlement organization and the importance and scale of communal commensal events in the late 13th and 14th centuries, domestic economies remained largely stable in the Cibola region. I suggest that the continuity observed in underlying economic structures represents the persistence of some degree of household autonomy and culinary freedom despite other marked changes in the size and sociopolitical organization of aggregated villages and nucleated towns. Even within settlement clusters, available evidence suggests that Cibola households may have experienced different levels of social pressures to participate in supra-household commensal events. The Cibola sequence thus offers an interesting contrast with developments in the political economies other regions to the west (i.e. Tonto Basin, Homol'ovi) and the north (i.e., Mesa Verde) where food storage, preparation, and/or cooking became increasingly communal and may have been controlled by more restricted groups as settlements grew in size (Lindauer 2002; Ortman 2008; Potter and Ortman 2004:181). As there is no archaeological evidence for centralized food storage in the Cibola region, it is likely individual households financed all commensal events. Future research will likely be able to better compare and contrast micro-and macro-scale developments in social and economic organization following population migration and aggregation in the northern U.S. Southwest.

Summary

Overall, food production and preparation intensified in conjunction with increases in the size of settlements and the scale of communal commensal events. Foodways played an important role in the process of establishing large, socially integrated communities, while at the same time widespread changes in social and settlement organization and increases in ritual feasting practices placed a lager burden on household stores and labor. Over the 13th and early 14th centuries, households likely experienced increasing social pressure to participate in communal commensal rituals. Women were likely the most affected by these changes as cuisine grew more complex and as their social roles and status within communities became more tightly tied to producing certain highly valued foods for communal commensal events. The changes in household and supra-household food activities documented in this study shed some light on the ways that the rapid and likely unsettling social transformations that accompanied population aggregation and settlement nucleation in the Cibola region in the late 13th and 14th centuries were experienced differently by individuals particularly along gendered lines. Altogether, the findings of this study support previous observations concerning changes in the political economies of coalescent communities and arguments made by Spielmann (2002) concerning the important links between ritual performance, economic intensification, and the foodways of small-scale societies.

Conclusions

The centrality of food in the making and maintenance of social relationships at multiple social scales makes foodways important to our understanding of how past societies related to and through food. To understand how foodways participated in social transformations in the past, archaeological analyses benefit by engaging more directly with the social dimensions of food. Studies of cuisine and commensality provide a unique view into social and political processes that can be usefully paired and compared to address the multifaceted relationships between broader changes in the environment and political economy and the everyday practicalities and uncertainties that shaped daily food practices in the past.

Comparative, longitudinal studies of foodways allow for more careful examination of the social and environmental contexts and mechanisms through which food practices are conserved, adopted, transformed, or even rejected in the past. In this study, multi-scalar perspectives were essential for addressing the relationships between daily food activities and broader processes of social, political and environmental change in the Cibola region. Future studies seeking to examine and compare trajectories of cuisine and commensality in small-scale societies will be strengthened by adopting approaches that consider the economic and symbolic ties between the foods and activities surrounding both daily meals and special feasting events. Especially when examining foodways in periods of social transformation, it is important to avoid artificially separating the domestic, embodied, and often unconscious aspects of "cookery" from the symbolic, overt, and performative nature of "cuisine" (Wilk 2006:104-105). Finally, studies of foodways are greatly strengthened through analyses of multiple lines of archaeological, ethnographic, and ethnoarchaeological evidence, and by adopting synthetic approaches that examine the full range of interrelated foods, technologies, bodily motions and places associated with food practices.

Anthropologists have long recognized the need for relational approaches in the study of social phenomenon (Mauss 1980). By focusing on foodways and their social dynamics through the dual lens of cuisine and commensality, this study provides unique insights into the social process and experience of living through periods of rapid population aggregation and social reorganization. For communities in the Cibola region this involved rapid changes in settlement and political organization and lasting transformations in terms of community formation, collective identification, and in the status and social roles of men and women. As many discussions of food and subsistence in the northern U.S. Southwest have been dominated by notions of, "a landscape of scarcity (Varien et al. 2017:68)," the ability of households and communities to intensify food production and consumption and complexify cuisine across the Cibola region over the 13^{th} and 14^{th} centuries is an important contribution of this study. First, it provides an example of how ancestral Zuni communities were able to thrive even through periods of social and climatic instability. This demonstrates how understandings and previous assumptions about relative food scarcity and abundance in the prehispanic Southwest are strengthened and improved by linking previously distinct economically and environmentally oriented studies of food production with more politically focused examinations of food serving and feasting. Second, this study highlights the important role and value of food in connecting individuals and households to larger communal and ritual life. Finally, this study draws attention to how individuals experienced and were able (or unable) to participate in processes of rapid social and political change differently along the lines of age, gender, and perhaps even religion or ethnicity through their foodways.

REFERENCES

Adams, E. Charles

1983 The Architectural Analogue to Hopi Social Organization and Room Use, and Implications for Prehistoric Northern Southwestern Culture. *American Antiquity*. 48:44–61.

1991 *The Origin and Development of the Pueblo Katsina Cult*. University of Arizona Press, Tucson.

2002 *Homol'ovi: an ancient Hopi settlement cluster*. University of Arizona Press, Tucson.

Adams, Charles E. and Andrew I. Duff (editors)

2004a *The Protohistoric Pueblo World A.D. 1275-1600*. University of Arizona Press, Tucson.

Adams, E. Charles and Andrew I. Duff

2004b Settlement Clusters and the Pueblo IV Period. In *The Protohistoric Pueblo World A.D. 1275-1600*, edited by Charles E. Adams and Andrew I Duff, pp. 3-16. University of Arizona Press, Tucson.

Adams, Jenny L.

1993 Toward Understanding the Technological Development of Manos and Metates. *Kiva* 58:331-344.

1994 The Development of Prehistoric Grinding Technology in the Point of Pines Area, East-Central Arizona. Unpublished PhD Dissertation, University of Arizona.

1999 Refocusing the Role of Food-Grinding Tools as Correlates for Subsistence Strategies in the US Southwest. *American Antiquity* 63:475-498.

2002 *Ground Stone Analysis: A Technological Approach*. University of Utah Press, Salt Lake City.

Adams, Jenny L. and David Greenwald

1979 *Stone Artifacts from Walpi, Part II. Walpi Archaeological Project, Phase II*, Vol. 4. Museum of Northern Arizona, Flagstaff.

Adams, Karen R.

1994 A Regional Synthesis of Zea mays in the Prehistoric American Southwest. In *Corn and Culture in the Prehistoric New World*, edited by Sissel Johannessen and Christine A. Hastorf, pp. 273-302, Westview Press, Boulder.

2007 Report on Analysis of 48 Flotation Samples from Archaeological Sites in the Zuni Area - Hinkson. Manuscript on file, School of Human Evolution and Social Change, Arizona State University, Tempe.

2014 Little Barley Grass (*Hordeum Pusillum* Nutt.): A Prehispanic New World Domesticate Lost to History. In *New Lives for Ancient and Extinct Crops*, edited by Paul E. Minnis, pp. 139–179. University of Arizona Press, Tucson.

2015 The Archaeology and Agronomy of Ancient Maize (*Zea mays* L.). In *Traditional Arid Lands Agriculture*, edited by Scott E. Ingram and Robert C. Hunt, pp. 15-53. University of Arizona Press, Tucson.

Adams, Karen R., Deborah A. Muenchrath, and Dylan M. Schwindt
1999 Moisture Effects on the Morphology of Ears, Cobs, and Kernels of a Southwestern U.S. Maize (*Zea mays* L.) Cultivar and Implications for the Interpretation of Archaeological Maize. *Journal of Archaeological Science* 26:483-496.

Adams, Karen R. and Shawn S. Murray
2004 *Identification Criteria for Plant Remains Recovered from Archaeological Sites in the Central Mesa Verde Region*. Electronic document, http://www.crowcanyon.org/plantID, accessed June 22, 2017.

Adams, Karen R. and Carla R. Van West
2005 Subsistence through Time in West-Central New Mexico and East-Central Arizona. In *Fence Lake Project: Archaeological Data Recovery in the New Mexico Transportation Corridor and First Five-Year Permit Area, Fence Lake Coal Mine Project, Catron County, New Mexico*, edited by E.K. Huber and Carla R. Van West, 37.1-37.50, Technical Series No. 84. Statistical Research, Inc., Tucson.

Adams, Karen R, Cathryn M. Meegan, Scott G. Ortman, R. Emerson Howell, Lindsay C. Werth, Deborah A. Muenchrath, Michael K. O'Neill, and Candice A. C. Gardner

2006 *MAIS (Maize of American Indigenous Societies) Southwest: Ear Descriptions and Traits that Distinguish 27 Morphologically Distinct Groups of 123 Historic USDA Maize (Zea mays L. spp. Mays) Accessions and Data Relevant to Archaeological Subsistence Models*. Accessions and Data Relevant to Archaeological Subsistence Models. Manuscript on file, http://farmingtonsc.nmsu.edu.

Adapon, Joy
2008 *Culinary Art and Anthropology*. Berg Publishers, Oxford.

Adler, Michael A. (editor)
1996a *The Prehistoric Pueblo World, A.D. 1150-1350*. University of Arizona Press, Tucson.

Adler, Michael A.
1996b Land Tenure, Archaeology, and the Ancestral Pueblo Social Landscape. *Journal of Anthropological Archaeology* 15:337-371.

Allen, Patricia Joan (editor)
1995 Prepared Foods. *Expedition* 37:26-40.

Appadurai, Arjun
1981 Gastro-Politics in Hindu South Asia. *American Ethnologist* 8:494–511.

1986 Introduction: Commodities and the Politics of Value. In *The Social Life of Things: Commodities in Cultural Perspective*, edited by Arjun Appadurai, pp. 3–63. Cambridge University Press, Cambridge.

1988 How to Make a National Cuisine: Cookbooks in Contemporary India. *Comparative Studies in Society and History* 30:3–24.

Anderies, John M.
2006 Robustness, Institutions, and Large-Scale Change in Socialecological Systems: The Hohokam of the Phoenix Basin. *Journal of Institutional Economics* 2:133–155.

Anyon, Roger, Susan M. Collins, and Kathyryn H. Bennett
1983 *Archaeological Investigations between Manuelito Canyon and Whitewater Arroyo Northwest New Mexico, vol.2*. Zuni Archaeology Program, 185. Zuni Archaeology Program, Zuni.

Atalay, Sonya and Christine A. Hastorf
2006 Food, Meals, and Daily Practice: Food Habitus at Neolithic Çatalhöyük. *American Antiquity* 71:283–319.

Badenhorst, Shaw and Jonathan C. Driver
2009 Faunal Changes in Farming Communities from Basketmaker II to Pueblo III (A.D. 1–1300) in the San Juan Basin of the American Southwest. *Journal of Archaeological Science* 36:1832–1841.

Bardolph, Dana N.
2014 Evaluating Cahokian Contact and Mississippian Identity Politics in the Late Prehistoric Central Illinois River Valley. *American Antiquity* 79:69–89.

Barrier, Casey R.

2011 Storage and Relative Surplus at the Mississippian Site of Moundville. *Journal of Anthropological Archaeology* 30:206–219.

Bartlett, K.

1933 *Pueblo Milling Stones of the Flagstaff Region and Their Relation to Others in the Southwest: A Study in Progressive Efficiency*. Bulletin No. 3. Museum of Northern Arizona, Flagstaff.

Baxter, Sylvester

1882 The Father of the Pueblos. *Harper's New Monthly Magazine* 65:72–91.

Beck, Margaret

2001 Archaeological Signatures of Corn Preparation in the U.S. Southwest. *Kiva* 67:187–218.

Bell, Willis H. and Edward F. Castetter

1941 The Utilization of Yucca, Sotol, and Beargrass by the Aborigines in the American Southwest. *Biological Series* 5 (5), *University of New Mexico Bulletin 372*. University of New Mexico, Albuquerque.

Benz, Bruce F.

1994 Can Prehistoric Racial Diversification Be Deciphered from Burned Corn Cobs? In *Corn and Culture in the Prehistoric New World*, edited by Sissel Johannessen and Christine A. Hastorf, pp. 23–33. Westview Press, Boulder.

Benz, Bruce F. and Hugh H. Iltis

1990 Studies in Archaeological Maize I: the "Wild" Maize from San Marcos Cave Reexamined. *American Antiquity* 55:500-511.

Bernardini, Wesley C.

1996 Transitions in Social Organization: A Predictive Model from Southwestern Archaeology. *Journal of Anthropological Archaeology* 15:372–402.

1998 Conflict, Migration, and the Social Environment: Interpreting Architectural Change in Early and Late Pueblo IV Aggregations. In *Migration and Reorganization: The Pueblo IV Period in the American Southwest*, edited Katherine A. Spielmann, pp. 91–109. Anthropological Research Papers, 51. Arizona State University, Tempe.

2005 *Hopi Oral Tradition and the Archaeology of Identity*. University of Arizona Press, Tucson.

Bettencourt, Luis M.A.

2013 The Origins of Scaling in Cities. *Science* 340:1438–1441.

Bettencourt, Luis M.A., Jose Lobo, Dirk Helbing, Christian Kuhnert, and Geoffrey B. West

2007 Growth, Innovation, Scaling, and the Pace of Life in Cities. *Proceedings of the National Academy of Sciences* 104:7301–7306.

Bettencourt, Luis M.A., Jose Lobo, Deborah Strumsky, and Geoffrey B. West

2010 Urban Scaling and Its Deviations: Revealing the Structure of Wealth, Innovation and Crime across Cities. *PLoS ONE* 5: e13541.

Bice, Richard

2006 The AS-6 Pueblo and Pithouse Site (LA 12133) North of Quemado, New Mexico. In *Ever Westward Papers in Honor of Elizabeth Kelley*, edited by Regge N. Wiseman, Thomas C. O'Laughlin, and Cordelia T. Snow, pp. 11–38. Archaeological Society of New Mexico, Albuquerque.

Birch, Jennifer (editor)

2013a *From Prehistoric Villages to Cities: Settlement Aggregation and Community Transformation*. Routledge, New York.

Birch, Jennifer

2013b Between Villages and Cities: Settlement Aggregation in Cross-Cultural Perspective. In *From Prehistoric Villages to Cities: Settlement Aggregation and Community Transformation*, edited by Jennifer Birch, pp. 1-22. Routledge, New York.

Bird, Robert McK.

1994 Manual for the Measurement of Maize Cobs. In *Corn and Culture in the Prehistoric New World*, edited by Sissel Johannessen and Christine A. Hastorf, pp. 5-54. Westview Press, Boulder.

Black, Andrew T.

n.d. Ojo Bonito Archaeological Project: 1988, Report of Investigations of Prehistoric Gridded Fields. Manuscript on file, School of Human Evolution and Social Change, Arizona State University, Tempe.

Blinman, Eric

1989 Potluck in the Protokiva: Ceramics and Ceremonialism in Pueblo I Villages. In *The Architecture of Social Integration in Prehistoric Pueblos*, edited by William D. Lipe and Michelle Hegmon, pp. 113–124. Occasional Paper, 1. Crow Canyon Archaeology Center, Cortez.

Blitz, John H.

1993 Big Pots for Big Shots: Feasting and Storage in a Mississippian Community. *American Antiquity* 58:80–96.

Bogaard, Amy, Michael Charles, Katheryn C. Twiss, Andrew Fairbairn, Nurcan Yalman, Dragana Filipovic, G. Arzu Demiregi, Füsun Ertuğ, Nerissa Russell, and Jennifer Henecke

2009 Private Pantries and Celebrated Surplus: Storing and Sharing Food at Neolithic Çatalhöyük, Central Anatolia. *Antiquity* 83:649–668.

Bohrer, Vorsila L.,

1960 Zuni Agriculture. *El Palacio* 67:181–202.

1973 Ethnobotany of Point of Pines Ruin, Arizona W:10:50. *Economic Botany* 27:423–437.

1975 The Prehistoric and Historic Role of the Cool-Season Grasses in the Southwest. *Economic Botany* 29:199-207.

1976 Peer Review. In *Desert Resources and Hohokam Subsistence: the Conoco Florence Project*, edited by W.H. Doelle, E.W. Bayham, E.W. Jernigan, and J.R. Wyant, pp. 245-250. Archaeological Series No. 103, Arizona State Museum, Tucson.

1986 The Ethnobotanical Pollen Record at Arroyo Hondo Pueblo. In *Food, Diet, and Population at Arroyo Hondo Pueblo*, New Mexico, edited by W. Wetterstrom, pp. 187-220. Arroyo Hondo Archaeological Series No. 6 School of American Research Press, Santa Fe.

1987 The Plant Remains from La Ciudad, a Hohokam Site in Phoenix. In *Specialized Studies in the Economy, Environment and Culture of La Ciudad, Part III*, edited by J. Kisselburg, G. Rice and B. Shears, pp. 67-238. Arizona State University Anthropological Field Studies No. 20. Arizona State University, Tempe.

1991 Recently Recognized Cultivated and Encouraged Plants among the Hohokam. *Kiva* 56:227-235.

1995 The Where, When, and Why of Corn Guardians. In *Soil, Water, Biology, and Belief in Prehistoric and Historic Southwestern Agriculture*, edited by H. Wolcott Toll, pp. 361–368. Special Publication, 2. New Mexico Archaeological Council, Albuquerque.

Boughknight, Aletheia

2014 Zooarchaeology of the Largo Gap Site. Unpublished MA Thesis, Washington University.

Borck, Lewis, Barbara J. Mills, Matthew A. Peeples, and Jeffery J. Clark

2015 Are Social Networks Survival Networks? An Example from the Late Pre-Hispanic Southwest. *Journal of Archaeological Method and Theory* 22:33-57.

Bourdieu, Pierre

1977 *Outline of a Theory of Practice*. Translated by Richard Nice. Cambridge University Press, Cambridge.

1984 *Distinction: A Social Critique of the Judgement of Taste*. Translated by Richard Nice. Harvard University Press, Cambridge, MA.

1986 The Forms of Capital. In *Handbook of Theory and Research for the Sociology of Education*, edited by John G. Richardson, pp. 241–258. Greenwood, New York.

Bowannie, Fred Jr., Andrew Laahty, and Patterson Peynetsa

1994 Mapping Fields in Nutria. *Zuni Farming for Today and Tomorrow* 3:1-5. Occasional newsletter of the Zuni Sustainable Agriculture Project and the Zuni Folk Varieties Project, Zuni.

Bradford, James E.

1980 *The Coronado Project Archaeological Investigations.* Coronado Series 1, MNA Research Paper 17. Museum of Northern Arizona, Flagstaff.

Brandt, Carol B.

1992 Archaeobotanical Analysis of Flotation Samples from Vogt Ranch, Ramah, New Mexico. Manuscript on file, Zuni Cultural Resource Enterprise, Zuni.

1994a Analysis of Plant Macro-Remains from Casa Malpais, Site AZ Q:15:3 (ASM). Ethnobiological Technical Series No. 94-1, Zuni Cultural Resource Enterprise, Zuni.

1994b Analysis of Plant Macro-Remains. In *Archaeological Data Recovery Excavations at the Sanders Great House and Six Other Sites along US Highway 191 South of Sanders, Apache County, Arizona*, edited by Thomas F. Fletcher. Zuni Archaeology Program Report No. 471, 9. Zuni Archaeology Program, Zuni.

Brandt, Carol B. and Patricia A. Ruppe

1990 Wood Use in the Zuni River Valley: The Archaeobotanical Data. Paper Presented at the Annual Meeting of the Society for Ethnobiology, Phoenix.

Bray, Tamara L. (editor)

2003a *The archaeology and politics of food and feasting in early states and empires*. Springer, Boston.

Bray, Tamara L.

2003b Inka Pottery as Culinary Equipment: Food, Feasting, and Gender in Imperial State Design. *Latin American Antiquity* 14:3-28.

Brumfiel, Elizabeth M.
1987 Consumption and Politics at Aztec Huexotla. *American Anthropologist* 89:676–686.

1991 Weaving and Cooking: Women's Production in Aztec Mexico. In *Engendering Archaeology: Women and Prehistory*, edited by J. M. Gero and M. W. Conkey, pp. 224–251. Blackwell, Oxford.

Brumfiel, Elizabeth M. and Cynthia Robin
2008 Gender, Households, and Society: An Introduction. *Archaeological Papers of the American Anthropological Association* 18:1–18.

Bruno, Maria C.
2014 Beyond Raised Fields: Exploring Farming Practices and Processes of Agricultural Change in the Ancient Lake Titicaca Basin of the Andes. *American Anthropologist* 116:130–145.

Bunzel, Ruth L.
1938 The economic organization of primitive peoples. In *General Anthropology*, edited by Franz Boaz, pp. 327-408. D.C. Heath, New York.

Burton, Jeffery F.
1990 *Archaeological Investigations at Puerco Ruin, Petrified Forest National Park, Arizona*. Western Archaeological and Conservation Center National Park Service, Publications in Anthropology 55. U.S. Department of the Interior, Tucson.

Cameron, Catherine M., Andrew I. Duff
2008 History and Process in Village Formation-Context and Contrasts from the Northern Southwest. *American Antiquity* 71:29–57.

CARP notes
n.d. Cibola Archaeological Research Project Archives. School of Human Evolution and Social Change, Arizona State University, Tempe, AZ.

Carballo, David M. (editor)
2012 *Cooperation and Collective Action: Archaeological Perspectives*. University Press of Colorado, Boulder.

Carballo, David M., Paul Roscoe, and Gary M. Feinman
2014 Cooperation and Collective Action in the Cultural Evolution of Complex Societies. *Journal of Archaeological Method and Theory* 21:98–133.

Carlson, Roy L.
1970 *White Mountain Redware: A Pottery Tradition of East-Central Arizona and Western New Mexico*. Anthropological Papers of the University of Arizona, 19. University of Arizona Press, Tucson.

Carney, Judith
2016 Fields of Survival, Foods of Memory. In *Geographies of Race and Food: Fields, Bodies, Markets*, edited by Rachel Slocum and Arun Saldanha, pp. 61–78. Routledge, London.

Casa Malpais Museum Notes
n.d. Archives of the Casa Malpais Project. Casa Malpais Archaeological Park and Museum, Springerville.

Castetter, Edward F., Ruth, M. Underhill
1935 *The ethnobiology of the Papago Indians*. Ethnobiological Studies in the American Southwest II, Ethnobiological Studies of the Papago Indians. University of New Mexico Bulletin (Biological Series) 4, Albuquerque.

Cesarreti, Rudolf, Jose Lobo, Julio L. Betancourt, Scott G. Ortman, and Michael E. Smith
2016 Population-Area Relationship for Medieval European Cities. *PLoS ONE* 1:1–27.

Chamberlin, Matthew A.
2002 Technology, Performance, and Intended Use: Glaze Ware Jars in the Pueblo IV Rio Grande. *Kiva* 67:269–296.

Ciolek-Torrello, Richard
1985 A Typology of Room Function at Grasshopper Pueblo, Arizona. *Journal of Field Archaeology* 12:41–63.

Clark, Tiffany
1998a Assessing Room Function Using Unmodified Faunal Bone: A Case Study from East-Central Arizona. *Kiva* 64:27–51.

1998b RCAP Fauna (tDAR id: 3513) ; doi:10.6067/XCV86Q1VPP.

2006 EMVPP Fauna (tDAR id: 3483) ; doi:10.6067/XCV8H41PN4.

2007 CARP Fauna (tDAR id: 3411) ; doi:10.6067/XCV8KD1WH1.

2008 ULCPP Fauna (tDAR id: 2846) ; doi:10.6067/XCV8125R1F.

Clark Tiffany C., Gregson Schachner, Suzanne L. Eckert, Todd L. Howell, and Deborah L. Huntley

2006 Rudd Creek Pueblo: A Late Tularosa Phase Village in East Central Arizona. *Kiva* 71:397-428.

Clark, Tiffany C., Gregson Schachner, and Keith Kintigh

2002 Archaeological Investigations at Rudd Creek Pueblo, a Tularosa Phase Site near Springerville, Apache County, Arizona. Manuscript on File, School of Human Evolution and Social Change, Arizona State University, Tempe.

Clary, K.H.

2000 Pollen Evidence for the prehistoric and historic economic plant utilization in Oak Wash, Zuni, New Mexico. In *The Archaeology and Ethnohistory of Oak Wash, Zuni Indian Reservation, New Mexico*, edited by Todd L. Howell, pp. 735-792. Zuni Cultural Resource Enterprise Report No. 664, Zuni Cultural Resource Enterprise, Zuni.

Cleveland, David A., Fred Bowannie Jr., Donald F. Eriacho, Andrew Laahty, and Eric Perramond

1995 Zuni Farming and United States Government Policy: The Politics of Biological and Cultural Diversity in Agriculture. *Agriculture and Human Values* 12:2-18.

Coltrain, Joan Brenner and Steven W. Leavitt

2002 Climate and Diet in Fremont Prehistory: Economic Variability and Abandonment of Maize Agriculture in the Great Salt Lake Basin. *American Antiquity* 67:453–485.

Cordell, Linda S.

1995 Tracing Migration Pathways from the Receiving End. *Journal of Anthropological Archaeology* 14: 203–211.

Cordell, Linda S., Carla Van West, Jeffery S. Dean, and Deborah A. Muenchrath

2007 Mesa Verde Settlement History and Relocation: Climate Change, Social Networks, and Ancestral Pueblo Migration. *Kiva* 72:379–405.

Costin, Cathy Lynne

1993 Textiles, Women, and the Political Economy in Late Prehispanic Peru. *Research in Economic Anthropology* 14:3–24.

Counihan, Carole M.

1999 *The Anthropology of Food and Body: Gender, Meaning, and Power*. Routledge, New York.

Counihan, Carole M., Penny Van Esterik (editors)

2013 *Food and Culture: A Reader*. New York: Routledge.

Crown, Patricia L. (editor)
2000a *Women and Men in the Prehispanic Southwest: Labor Power and Prestige*. School of American Research Advanced Seminar Series, Santa Fe.

Crown, Patricia L.
1994 *Ceramics and Ideology: Salado Polychrome Pottery*. University of New Mexico Press, Albuquerque.

2000b Gendered Tasks, Power, and Prestige in the Prehispanic American Southwest. In *Women and Men in the Prehispanic Southwest: Labor Power and Prestige*, edited by Patricia L. Crown, pp. 3-41. School of American Research Advanced Seminar Series, Santa Fe.

2000c Women's Role in Changing Cuisine. In *Women and Men in the Prehispanic Southwest: Labor Power and Prestige*, edited by Patricia L. Crown, pp. 221–266. School of American Research Advanced Seminar Series, Santa Fe.

2018 Drinking Performance and Politics in Pueblo Bonito, Chaco Canyon. *American Antiquity* 83:387–406.

Crown, Patricia L. and Suzanne K. Fish
1996 Gender and Status in the Hohokam Pre-Classic to Classic Transition. *American Anthropologist* 98:803–817.

Curtin, Deane W.
1992 Food/Body/Person. In *Cooking, Eating, Thinking: Transformative Philosophies of Food*, edited by Deane W. Curtin and Lisa M. Heldke, pp. 3–22. Indiana University Press, Bloomington.

Curtin, Leonora S.M.
1984 *By the Prophet of the Earth, Ethnobotany of the Pima*. The University of Arizona Press, Tucson.

Cushing, Frank Hamilton
1888 Preliminary Notes on the Origin, Working Hypothesis and Primary Researches of the Hemengway Southwestern Archaeological Expedition. *Proceedings of the International Congress of the Americanists* 7:151–194.

1920 *Zuni Breadstuff*. Indian Notes and Monographs No. 8. Museum of the American Indian, New York.

1967 *My Adventures in Zuñi*. Filter Press, Palmer Lake.

Cutler, Hugh C.
1964 Plant Remains from the Carter Ranch Site. In *Chapters in the Prehistory of Eastern Arizona II*, Fieldiana: Anthropology vol. 55, edited by P. S. Martin, J. B. Rinaldo, W. A. Longacre, L. G. Freeman Jr., J. A. Brown, R. H. Hevly, and M. E. Cooley, pp. 227-234. Chicago Natural History Museum, Chicago

Cutler, Hugh C and Winton Meyer
1965 Corn and Cucurbits from Wetherill Mesa. *American Antiquity* 31:136-152.

Damp, Jonathan
2007 Zuni Emergent Agriculture: Economic Strategies and the Origins of Zuni. In *Zuni Origins: Toward a New Synthesis of Southwestern Archaeology*, edited by David A. Gregory and David R. Wilcox, pp. 118–132. University of Arizona Press, Tucson.

Damp, Jonathan, S.A. Hall, and Susan Smith
2002 Early Irrigation on the Colorado Plateau near Zuni Pueblo, New Mexico. *American Antiquity* 67:665–676.

Damp, Jonathan and Jeffery Waseta (editors)
2004 To Command and Carry the Waters: An Archaeological Inventory and Analysis of the Excavations at *K'Yawa:Na'a Deyatchinanne* (NM:12:K3:392) Zuni, New Mexico. Zuni Cultural Resource Enterprise Report, 670. Zuni Cultural Resource Enterprise, Zuni.

Danson, Edward Bridge
1957 An Archaeological Survey of West Central New Mexico and East Central Arizona. *Papers of the Peabody Museum*, 44. Harvard University Press, Cambridge.

Danson, Edward Bridge and Harold Malde
1950 Casa Malpais, a Fortified Pueblo Site at Springerville, Arizona. *Plateau* 22:61–67.

Dean, Jeffery S.
2007 Zuni-Area Paleoenvironment. In *Zuni Origins: Toward a New Synthesis of Southwestern Archaeology*, edited by David A. Gregory and David R. Wilcox, pp. 77–94. University of Arizona Press, Tucson.

Dean, Rebecca M.
2001 Social Change and Hunting during the Pueblo III to Pueblo IV Transition, East-Central Arizona. *Journal of Field Archaeology* 28:271-285.

Dedecker, Melanie A.
2005 The Piki Complex at the Homol'ovi Settlement Cluster: Defining the Power, Prestige, and Status of Women at a Pueblo IV Community. Unpublished MA Thesis, University of Arizona.

deFrance, Susan
1996 Iberian Foodways in the Moquigua and Torata Valleys of Southern Peru. *Historical Archaeology* 30:20–48.

DeGarmo, Glen Dean
1975 Coyote Creek, Site 01: A Methodological Study of a Prehistoric Pueblo Population. Unpublished PhD dissertation, University of California, Los Angeles.

DeSoucey, Michaela
2010 Gastronationalism: Food Traditions and Authenticity Politics in the European Union. *American Sociological Review* 75:432–455.

Dietler, Michael
1990 Driven by drink: The role of drinking in the political economy and the cast of early Iron Age France, *Journal of Anthropological Archaeology* 9:352– 406.

1996 Feasts and Commensal Politics in the Political Economy: Food, Power, and Status in Prehistoric Europe. In *Food and the Status Quest: An Interdisciplinary Perspective*, edited by P. Wiessner and Wulf Schiefenhövel, pp. 87–125. Berghahn Books, Providence.

2001 Theorizing the feast: Rituals of consumption, commensal politics, and power in African contexts. In *Feasts: Archaeological and ethnographic perspectives on food, politics and power*, edited by M. Dietler and B. Hayden, pp. 65-114. Smithsonian Institution Press, Washington DC.

Dietler, Michael and Brian Hayden (editors)
2001a *Feasts Archaeological and Ethnographic Perspectives on Food, Politics and Power*. University of Alabama Press, Tuscaloosa.

Dietler, Michael and Brian Hayden
2001b Digesting the Feast: Good to Eat, Good to Drink, Good to Think. In *Feasts: Archaeological and ethnographic perspectives on food, politics and power*, edited by M. Dietler and B. Hayden, pp. 1-20. University of Alabama Press, Tuscaloosa.

Doebley, John F.
1984 "Seeds" of Wild Grasses: A Major Food of Southwestern Indians. *Economic Botany* 38:52-64.

Doebley, John and Vorsila L. Bohrer
1983 Maize Variability and Cultural Selection at Salmon Ruin, New Mexico. *Kiva* 49:19-37.

Dorsey, G.A.
1899 The Hopi Indians of Arizona. *Popular Science Monthly* 55:732-750.

Dosh, Steven G.
1988 *Subsistence and Settlement Along the Mogollon rim A.D. 1000-1150*. MNA Research Paper 39, Museum of Northern Arizona Press, Flagstaff.

Douglas, Mary
1966 *Purity and Danger*. Praeger, New York.

1972 Deciphering a Meal. *Daedalus* 101:61–81.

1984 Standard Social Uses of Food: Introduction. In *Food in the Social Order: Studies of Food and Festivities in Three American Communities*, edited by Mary Douglas, pp. 1-39. Russell Sage Foundation, New York.

Douglas, Mary and Michael Nicod
1974 Taking the Biscuit: The Structure of British Meals. *New Society* 19:744–747.

Doyel, David E. and Sharon S. Debowski
1980 *Prehistory in Dead Valley, East-Central Arizona: The TG&E Springerville Project*. Archaeological Series No. 144, Arizona State Museum, Tucson.

Driver, Jonathan C.
2002 Faunal Variation and Change in the Northern San Juan Region. In *Seeking the Center Place: Archaeology and Ancient Communities in the Mesa Verde Region*, edited by Mark D. Varien and R.H. Wilshusen, pp. 143–160. University of Utah Press, Salt Lake City.

Driver, Jonathan C. and Joshua R. Woiderski
2008 Interpretation of the "Lagomorph Index" in the American Southwest. *Quaternary International* 185:3–11.

Duff, Andrew I.
2002 *Western Pueblo Identities: Regional Interaction, Migration, and Transformation*. University of Arizona Press, Tucson.

2004 Settlement Clustering and Village Interaction in the Upper Little Colorado. In *The Protohistoric Pueblo World A.D. 1275-1600*, edited by E. Charles Adams, Andrew I. Duff, pp. 75–84. University of Arizona Press, Tucson.

Duff, Andrew I. and Stephen H. Lekson
2006 Notes from the South. In *The Archaeology of Chaco Canyon, An Eleventh Century Pueblo Regional Center*, edited by Stephen H. Lekson, pp. 315–337. School of American Research Press, Santa Fe.

Duff, Andrew I. and Gregson Schachner
2007 Becoming Central, Organizational Transformations in the Emergence of Zuni. In *Hinterlands and Regional Dynamics in the Ancient Southwest*, edited by A.P. Sullivan and J. Bayman, pp. 185–200. University of Arizona Press, Tucson.

Dunbar, Robin I.
1992 Neocortex Size as a Constraint on Group Size in Primates. *Journal of Human Evolution* 20:469–493.

1998 The Social Brain Hypothesis. *Evolutionary Anthropology* 6:178–190.

Dungan, Katherine A. and Matthew A. Peeples
2018 Public Architecture as Performance Space in the Prehispanic Central Southwest. *Journal of Anthropological Archaeology* 50:12–26.

Earle, Timothy
1997 *How Chiefs Come to Power: The Political Economy in Prehistory*. Stanford University Press, Stanford.

2002 *Bronze Age Economics: The Beginnings of Political Economies*. Westview Press, Boulder.

Ebeling, Walter
1986 *Handbook of Indian Foods and Fibers of Arid America*. University of California Press, Berkeley.

Eckert, Suzanne L.
2012 Choosing Clays and Painting Pots in the Fourteenth-Century Zuni Region. In *Potters and Communities of Practice: Glaze Paint and Polychrome Pottery in the American Southwest A.D. 1250-1700*, edited by Linda S. Cordell and Judith A. Habicht-Mauche, pp. 55-64. University of Arizona Press, Tucson.

Eckstein, Susan
2001 Community as Gift-Giving: Collectivistic Roots of Volunteerism. *American Sociological Review* 66:829–851.

Edaakie, Rita
1999 *Idonapshe Let's Eat Traditional Zuni Foods*. A:shiwi A:wan Museum and Heritage Center, University of New Mexico Press, Albuquerque.

Ellwood, Emily C., Paul M. Scott, William D. Lipe, R.G. Matson, and John G. Jones
2013 Stone-Boiling Maize with Limestone: Experimental Results and Implications for Nutrition among SE Utah Preceramic Groups. *Journal of Archaeological Science* 40:35–44.

EMVPP notes
n.d. El Morro Valley Prehistory Project Archives. School of Human Evolution and Social Change, Arizona State University, Tempe.

Ermigiotti, Paul, Mark, Varien, Erin Bohm, Kyle Bocinsky, the Hopi Cultural Preservation Office, and the Hopi Cultural Resources Advisory Task Team
2018 The Pueblo Farming Project: A collaboration between Hopi Farmers and the Crow Canyon Archaeological Center. Electronic document, https://www.crowcanyon.org/institute/pfp, accessed 17 August 2018.

Etnier, Michael A.
1997 Dietary Change at Lower Pescado Village (NM12-I109). Unpublished MA Thesis, University of Washington, St. Louis.

Ezzo, Joseph A.
1993 *Human Adaptation at Grasshopper Pueblo, Arizona*. International Monographs in Prehistory. Archaeological Series, 4. University of Michigan, Ann Arbor.

Fan, Judith E.
2013 Can Ideas about Food Inspire Real Social Change? The Case of Peruvian Gastronomy. *Gastronomica* 13:29–40.

Farb, Peter and George Armelagos
1980 *Consuming Passions: The Anthropology of Eating*. Houghton Mifflin, New York.

Feinman, Gary M.
2011 Size, Complexity, and Organizational Variation: A Comparative Approach. *Cross-Cultural Research* 45:37–58.

Feinman, Gary M., Kent G. Lightfoot, Steadman Upham
2000 Political Hierarchies and Organizational Strategies in the Puebloan Southwest. *American Antiquity* 65:449–470.

Ferguson, T.J., Richard E. Hart
1985 *A Zuni Atlas*. University of Oklahoma, Norman.

Ferguson, T.J. and Barbara J. Mills
1987 Settlement and Growth of Zuni Pueblo: An Architectural History. *Kiva* 52:243–266.

Fischler, Claude

1988 Food, Self and Identity. *Social Science Information* 27:275–92.

Fish, Suzanne K.

1984 Agriculture and Subsistence Implications of the Salt-Gila Aqueduct Project Pollen Analysis. In *Hohokam Archaeology along the Salt-Gila Aqueduct, Central Arizona Project: 7. Environment and Subsistence*, edited by Lynne S. Teague and Patricia L. Crown, pp. 111-138. Archaeological Series 150. Arizona State Museum, Tucson.

2000 Farming, Foraging, and Gender. In *Women and Men in the Prehispanic Southwest: Labor Power and Prestige*, edited by Patricia L. Crown, pp. 169–196. School of American Research Advanced Seminar Series, Santa Fe.

2004 Corn, Crops, and Cultivation in the North American Southwest. In *People and Plants in Ancient Western North America*, edited by Paul E Minnis, pp. 115–166. Smithsonian Books, Washington.

Fish, Suzanne K. and Paul R. Fish

2015 Understanding the Agricultural Consequences of Aggregation. In *Traditional Arid Lands Agriculture Understanding the Past for the Future*, edited by Scott E. Ingram and Robert C. Hunt, pp. 306–329. University of Arizona Press, Tucson.

Fletcher, Thomas F.

1994 *Archaeological Data Recovery Excavations at the Sanders Great House and Six Other Sites along US Highway 191 South of Sanders, Apache County, Arizona*. Zuni Archaeology Program Report No. 471, Research Series No. 9. Zuni Archaeology Program, Zuni.

Flora, Cornelia Butler, Matt Livingston, Iva Honyestewa, and Harrissa Koiyaquaptewa

2009 Understanding Access to and Use of Traditional Foods by Hopi Women. *Journal of Hunger & Environmental Nutrition* 4:158–171.

Foley, A. J., N. Ramankutty, A.K. Brauman, S.E. Cassidy, S.J. Gerber, M. Johnston, D.N. Mueller, C. O'Connell, K.D. Ray, C.P. West, C. Balzer, M.E. Bennett, R.S. Carpenter, J. Hill, C. Monfreda, S. Polasky, J. Rockstromm, J. Sheehan, S. Siebert, D. Tilman, and M.P.D. Zaks

2011 Solutions for a cultivated planet. *Nature* 478:337-342.

Ford, Richard I.

1972 An Ecological Perspective on the Eastern Pueblos. In *New Perspectives on the Pueblos*, edited by Alfonso Ortiz, pp. 1–17. School of American Research Book. University of New Mexico Press, Albuquerque.

1980 The Color of Survival. *Discovery*: 17–29.

Fowler, Andrew P., John R. Stein, and Roger Anyon
1987 An Archaeological Reconnaissance of West-Central New Mexico: The Anasazi Monuments Project. Submitted to the Office of Cultural Affairs, Historic Preservation Division, State of New Mexico.

Fowler, Andrew P. and John R. Stein
1992 The Anasazi Great House in Space, Time, and Paradigm. In *Anasazi Regional Organization and the Chaco System*, edited by D.E. Doyel, pp. 101-122. University of New Mexico Press, Albuquerque.

Frank, Lois Ellen
2011 The Discourse and Practice of Native American Cuisine: Native American Chefs and Native American Cooks in Contemporary Southwest Kitchens. Unpublished PhD Dissertation, University of New Mexico.

Fuller, Dorian Q.
2005 Ceramics, Seeds, and Culinary Change in Prehistoric India. *Antiquity* 79:761–777.

Gasser, Robert E.
1982 Anasazi Diet. In *The Coronado Project Archaeological Investigations. The Specialists' Volume: Biocultural Analyses*, edited by R.E. Gasser, pp. 8-95. Museum of Northern Arizona, Coronado Series 4, MNA Research Paper 23, Museum of Arizona Press, Flagstaff.

Gasser, Robert E. and E. Charles Adams
1981 Aspects of Deteriorations of Plant Remains in Archaeological Sites: The Walpi Archaeological Project. *Journal of Ethnobiology* 1:182–192.

Gasser, Robert E. and Scott M. Kwiatkowski
1991 Regional Signatures of Hohokam Plant Use. *Kiva* 56:207–226.

Gebauer, Rachel
2003 Colonialism and Food Processing at Zuni Pueblo. Presented at the Colonialism and Culture Change at Zuni Pueblo, 1300-Present, Amerind Foundation Advanced Seminar, Dragoon.

Gero, Joan M.
1992 Feasts and Females: Gender Ideology and Political Meals in the Andes. *Norwegian Archaeological Review* 25:1–16.

Gero, Joan, M., Margaret W. Conkey (editors)
1991 *Engendering Archaeology: Women and Prehistory*. Wiley-Blackwell, Oxford.

Gifford-Gonzales, Diane

2008 Thoughts on a method for zooarchaeological study of daily life. In *Interpreting household practices: reflections on the cultural and social roles of maintenance activities*, edited by P. González Marcén, S. Montón Subias, and M. Picazo, pp. 15–23. British Archaeological Reports, Oxford.

Gillespie, William B.

1990 Faunal Remains. In *Archaeological Investigations at Puerco Ruin, Petrified Forest National Park*, edited by J.F. Burton, pp. 205–230. Publications in Anthropology, 54. Western Archaeological and Conservation Center, Tucson.

Gilpin, Dennis (editor)

2004 *Archaeological Excavations in the Carrizo Wash Valley, East-Central Arizona: Data Recovery on the Fence Lake Mine Transportation Corridor*. SWCA Cultural Resource Report, 03–265. SWCA, Phoenix.

Gish, Jennifer W.

1983 Pollen analysis. In *Archaeological Investigations Between Manuelito Canyon and Whitewater Arroyo Northwest New Mexico,* Vol. 2, edited by R. Anyon and S.M. Collins, pp. 649-698. Zuni Archaeology Program Report Number 185, Zuni Archaeology Program, Zuni.

1991 Current Perceptions, Recent Discoveries, and Future Directions in Hohokam Palynology. *Kiva* 60:203-218.

1995 Thirteen Pollen Samples from the Lower Pescado Site, Zuni Indian Reservation, New Mexico. In *The Zuni Farming Village Study and Excavations at Lower Pescado Village: A Report on the Columbia/Barnard Archaeological Field School 1989-1991,* edited by Nan A. Rothschilde and Susan A. Dublin, S.A. Submitted to Pueblo of Zuni, Zuni, New Mexico.

Glowacki, Donna and Scott Van Keuren (editors)

2011 *Religious Transformation in the Late Pre-Hispanic Southwest*. University of Arizona Press, Tucson.

Gnabasik, Virginia

1981 Faunal Utilization by the Pueblo Indians. Unpublished MA thesis, Eastern New Mexico University.

Godfray, H. Charles J., John R. Beddington, Ian R. Crute, Lawrence Haddad, David Lawrence, James F. Muir, Jules Pretty, Sherman Robinson, Sandy M. Thomas, and Camilla Toulmin

2010 Food security: The challenge of feeding 9 billion people. *Science* 327:812-818.

Goody, Jack
1982 *Cooking, cuisine and class: a study in comparative sociology*. Cambridge University Press, Cambridge.

Gosden, Chris
1999 Introduction. In *The Prehistory of Food: Appetites for Change*, edited by Chris Gosden and Jon Hather, pp. 1–9. Routledge, London.

Graff, Sarah R., Enrique Rodriguez-Elia (editors)
2012 *The Menial Art of Cooking: Archaeological Studies of Cooking and Food Preparation*. University of Colorado Press, Boulder.

Graves, William M. and Katherine A. Spielmann
2000 Leadership, Long-Distance Exchange, and Feasting in the Protohistoric Rio Grande. In *Alternative Leadership Strategies in the Southwest*, edited by Barbara J. Mills, pp. 46–59. University of Arizona Press, Tucson.

Gregory, David A. and David R. Wilcox (editors)
2007 *Zuni Origins: Towards a New Synthesis of Southwestern Archaeology*. University of Arizona Press, Tucson.

Gumerman, George IV
1997 Food and Complex Societies. *Journal of Archaeological Method and Theory* 4:105–139.

Haaland, Randi
2007 Porridge and Pot, Bread and Oven: Food Ways and Symbolism in Africa and the Near East from the Neolithic to the Present. *Cambridge Archaeological Journal* 17:165-182.

Hally, David J.
1986 The Identification of Vessel Function: A Case Study of Northwest Georgia. *American Antiquity* 51:267-297.

Hamilakis, Yannis
1999 Food technologies/technologies of the body: The social context of wine and oil production and consumption in Bronze Age Crete. *World Archaeology* 31: 38–54.

Harbottle, Lynn
1997 Taste and embodiment: the food preferences of Iranians in Britain. In *Food Preferences and Taste*, edited by H. Macbeth, pp. 175-185. Berghahn Books, Providence.

Hard, Robert J., Raymond P. Maudlin, and Gerry R. Raymond

1996 Mano Size, Stable Carbon Isotope, and Macrobotanical Remains as Multiple Lines of Evidence of Maize Dependence in the American Southwest. *Journal of Archaeological Method and Theory* 3:253–318.

Harrington, H.D.

1967 *Edible Native Plants of the Rocky Mountains*. University of New Mexico Press, Albuquerque.

HARP notes

n.d. Heshotauthla Archaeological Research Project Archives. School of Human Evolution and Social Change, Arizona State University, Tempe.

Hastorf, Christine A.

1991 Gender, space and food in prehistory. In *Engendering archaeology: Women and prehistory*, edited by Joan Gero and Margaret Conkey, pp. 132-159. Basil Blackwell Press, Cambridge, MA.

2012 Steamed or Boiled: Identity and Value in Food Preparation. *eTopoi* Journal for Ancient Studies 2:213-242.

2016 *The Social Archaeology of Food: Thinking about Eating from Prehistory to the Present*. Cambridge University Press, New York.

Hastorf, Christine A, and Lin Foxhall

2017 The Social and Political Aspects of Food Surplus. *World Archaeology* 49:26–39.

Hayden, Brian

1987 Past to present uses of stone tools in the Maya highlands. In *Lithic studies among the contemporary highland Maya*, edited by Brian Hayden, pp. 160-324. University of Arizona Press, Tucson.

1990 Nimrods, Piscators, Pluckers, and Planters: The Emergence of Food Production. *Journal of Anthropological Archaeology* 9:31–69.

1996 Feasting in prehistoric and traditional societies. In *Food and the Status Quest*, edited by Polly Wiessner and Wulf Schiefenhövel, pp. 127-147. Berghahn Books, Oxford.

2001 Fabulous Feasts: A Prolegomenon to the Importance of Feasting. In *Feasts: Archaeological and Ethnographic Perspectives on Food, Politics and Power*, edited by Michael Dietler and Brian Hayden, pp. 23–64. Smithsonian Institution, Washington, D.C.

Hayden, Brian and Aubery Cannon
1984 *The Structure of Material Systems: Ethnoarchaeology in the Maya Highlands*, SAA Papers No. 3. Society for American Archaeology, Washington, DC.

Hayden, Brian, Laurie Nixon-Darcus, and Logan Ansell
2016 Our 'daily bread'? The origins of grinding grains and breadmaking. In *Exploring the Materiality of Food 'Stuffs': Transformations, Symbolic Consumption and Embodiments*, edited by L. Steel and K. Zinn, pp. 57-78. Rutledge, New York.

Hayden, Brian and Villeneuve Suzanne
2011 A century of feasting studies. *Annual Review of Anthropology* 40:433–449.

Hegmon, Michelle (editor)
2000 *The Archaeology of Regional Interaction*. University Press of Colorado, Boulder.

Hegmon, Michelle
1991 The Risks of Sharing and Sharing as Risk Reduction: Interhousehold Food Sharing in Egalitarian Societies. In *Between Bands and States*, edited by Susan A. Gregg, pp. 309–329. Occasional Paper, 9. Southern Illinois University, Center for Archaeological Investigations, Carbondale.

1996 Variability in Food Production, Strategies of Storage and Sharing, and the Pithouse-to-Pueblo Transition in the Northern Southwest. In *Evolving Complexity and Environmental Risk in the Prehistoric Southwest*, edited by Joseph A. Tainter and Bonnie Bagley Tainter, pp. 223–250. Addison-Wesley Publishing Company, Reading.

Hegmon, Michelle, Matthew A. Peeples, Ann P. Kinzig, Stephanie Kulow, Cathryn M. Meegan, and Margaret C. Nelson
2008 Social Transformation and Its Human Cost in the Prehispanic U.S. Southwest. *American Anthropologist* 110: 313-324.

Hegmon, Michelle, Jacob Freeman, Keith W. Kintigh, Margaret C. Nelson, Sarah Oas, Matthew A. Peeples, and Andrea Torvinen.
2016 Marking and Making Difference: Representational Diversity in the US Southwest. *American Antiquity* 81:253-272.

Hendon, Julia A.
1996 Archaeological Approaches to the Organization of Domestic Labor: Household Practice and Domestic Relations. *Annual Review of Anthropology* 25: 45–61.

2000 Having and Holding: Storage, Memory, Knowledge, and Social Relations. *American Anthropologist* 102:42–53.

Herr, Sarah A.
2001 *Beyond Chaco: Great Kiva Communities on the Mogollon Rim Frontier*. Anthropological Papers of the University of Arizona, 66. University of Arizona Press, Tucson.

Hill, J. Brett, Jeffery J. Clark, William H. Doelle, and Patrick D. Lyons
2004 Prehistoric Demography in the Southwest: Migration, Coalescence, and Hohokam Population Decline. *American Antiquity* 69:689–716.

Hill, James N.
1970 *Broken K Pueblo Prehistoric Social Organization in the American Southwest*. Anthropological Papers of the University of Arizona No. 18, University of Arizona Press, Tucson, Arizona.

Hillman, Gordon.
1981 Reconstructing Crop Husbandry Practices from Charred Remains of Crops. In *Farming Practice in British Prehistory*, edited by R.J. Mercer: pp. 123–162. Edinburgh University Press, Edinburgh.

Holtzman, Jon D.
2006 Food and Memory. *Annual Review of Anthropology* 35:361–378.

Horlings, L.G. and T.K. Marsden
2011 Towards the Real Green Revolution? Exploring the Conceptual Dimensions of a New Ecological Modernisation of Agriculture That Could 'Feed the World.' *Global Environmental Change* 21:441–452.

Howell, Todd L.
2000 *The Archaeology and Ethnohistory of Oak Wash, Zuni Indian Reservation, New Mexico, Part 1*. Zuni Cultural Resource Enterprise Report, 664. Zuni Cultural Resource Enterprise, Zuni.

2004 *Archaeological Investigations at Site LA 132353 for the Proposed New Ramah High School, Ramah, McKinley County, New Mexico.* Zuni Cultural Resource Enterprise Report No. 819. Zuni Cultural Resource Enterprise, Zuni.

Huber, Edgar K., Carla R. Van West
2006 *Fence Lake Project: Archaeological Data Recovery in the New Mexico Transportation Corridor and First Five-Year Permit Area, Fence Lake Coal Mine Project, Catron County, New Mexico. Volume 3: Environmental Studies, Technical Series 84*. Statistical Research, Inc., Tucson.

Huckell, Lisa W.
2006 Ancient Maize in the American Southwest: What Does It Look like and What Can It Tell Us? In *Histories of Maize: Multidisciplinary Approaches to the Prehistory, Linguistics, Biogeography, Domestication, and Evolution of Maize*, edited by J. Staller, R. Tykot, and B. Benz, pp. 97–107. Elsevier, Amsterdam.

Huckell, Lisa W. and Mollie S. Toll
2004 Wild Plant Use in the North American Southwest. In *People and Plants in Ancient Western North America*, edited by Paul E. Minnis, pp. 37–114. Smithsonian Books, Washington D.C.

Huntley, Deborah L.
2008 *Ancestral Zuni Glaze-Decorated Pottery: Viewing Pueblo IV Regional Organization through Ceramic Production and Exchange*. Anthropological Papers of the University of Arizona, 72. University of Arizona Press, Tucson.

Huntley, Deborah L. and Keith W. Kintigh
2004 Archaeological Patterning and Organizational Scale of Late Prehistoric Settlement Clusters in the Zuni Region of New Mexico. In *The Protohistoric Pueblo World: A.D. 1275-1600*, edited by Charles E. Adams and Andrew I. Duff, pp. 62–74. University of Arizona Press, Tucson.

Isbell, William H.
2000 What We Should Be Studying: The "Imagined Community" and the "Natural Community." In *The Archaeology of Ancient Communities: A New World Perspective*, edited by Marcello A. Canuto and Jason Yaeger, pp. 243–266. Routledge, London.

James, Steven Randall
1994 Regional Variation in Prehistoric Pueblo Households and Social Organization: A Quantitative Approach. Unpublished PhD Dissertation, Arizona State University.

Janer, Zilkia
2007 (IN)EDIBLE NATURE New World Food and Coloniality. *Cultural Studies*:385–405.

Johnson, Allen W. and Timothy Earle
2000 *The Evolution of Human Societies: From Foraging Groups to Agrarian State* 2nd edition. Stanford University Press, Stanford.

Johnson, Gregory A.
1982 Organizational Structure and Scalar Stress. In *Theory and Explanation in Archaeology: The Southampton Conference*, edited by Colin Renfrew, Michael J. Rowlands, and Barbara Abbott Seagraves, pp. 389-421. Academic Press, New York.

1983 Decision Making Organization and Pastoral Camp Size. *Human Ecology* 11:175-199.

Jones, Glynis
1984 Interpretation of Archaeological Plant Remains: Ethnographic Models from Greece. In *Farming Practice in British Prehistory*, edited by R.J. Mercer, pp. 42–61.Edinburgh University Press, Edinburgh.

Joyce, Rosemary A. and John S. Henderson
2007 From Feasting to Cuisine: Implications of Archaeological Research in an Early Honduran Village. *American Anthropologist* 109:642-653.

Kaldahl, Eric, Scott Van Keuren, and Barbara J. Mills
2004 Migration, Factionalism, and the Trajectories of Pueblo IV Period Clusters in the Mogollon Rim Region. In *The Protohistoric Pueblo World: A.D. 1275-1600*, edited by E. Charles Adams and Andrew I. Duff, pp. 85–94. University of Arizona Press, Tucson.

Katz, S, M.L. Hediger, and L.A. Valleroy
1974 Traditional Maize Processing Techniques in the New World. *Science* 184:765–773.

Kellner, Corina M., Margaret J. Schoeninger, Katherine A. Spielmann, and Katherine Moore
2010 Stable Isotope Data Show Temporal Stability in Diet at Pecos Pueblo and Diet Variation among Southwest Pueblos. In *Pecos Pueblo Revisited: The Biological and Social Context*, edited by M.E. Morgan, pp. 79–92. Harvard University Press, Cambridge, MA.

Kidder, Alfred V.
1927 Southwestern Archaeological Conference. *Science* 66:489–491.

Kindscher, Kelly, Quinn Long, Steve Corbett, Kirsten Bosnak, Hillary Loring, Mark Cohen, and Barbara N. Timmermann
2012 The Ethnobotany and Ethnopharmacology of Wild Tomatillos, *Physalis longifolia* Nutt., and Related *Physalis* Species: A Review. *Economic Botany* 66: 298-310.

King, Frances B.
1994 Variability in Cob and Kernel Characteristics. In *Corn and Culture in the Prehistoric New World*, edited by Sissel Johannessen and Christine A. Hastorf, pp. 35-54. Westview Press, Boulder.

Kintigh Keith, W.
1985 *Settlement, Subsistence, and Society in Late Zuni Prehistory*. University of Arizona Press, Tucson.

1994 Chaco, Communal Architecture, and Cibolan 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. 131–140. University of New Mexico Press, Albuquerque.

1996 The Cibola Region in the Post-Chacoan Era. In *The Prehistoric Pueblo World, AD 1150-1350*, edited by Michael A. Adler, pp. 131–144. University of Arizona Press, Tucson.

2007 Late Prehistoric and Protohistoric Settlement Systems in the Zuni Area. In *Zuni Origins: Toward a New Synthesis of Southwestern Archaeology*, edited by D.A. Gregory and D.R. Wilcox, pp. 361-376. University of Arizona Press, Tucson.

Kintigh, Keith, W., Todd L. Howell, and Andrew I. Duff.
1996 Post-Chacoan Social Integration at the Hinkson Site, New Mexico. *Kiva* 61:257-274.

Kintigh, Keith W., Donna M. Glowacki, and Deborah L. Huntley
2004 Long-Term Settlement History and the Emergence of Towns in the Zuni Area. *American Antiquity* 69:432-456.

Klarich, Elizabeth A.
2010 *Inside Ancient Kitchens New Directions in the Study of Daily Meals and Feasts*. University Press of Colorado, Boulder.

Kohler, Timothy A. and Meredith H. Matthews
1988 Long-Term Anasazi Land Use and Forest Reduction: A Case Study from Southwest Colorado. *American Antiquity* 53:537–564.

Kohler, Timothy A., Stephanie VanBuskirk, and Samantha Ruscavage-Barz
2004 Vessels and Villages: Evidence for Conformist Transmission in Early Village Aggregations on the Pajarito Plateau, New Mexico. *Journal of Anthropological Archaeology* 23:199–118.

Kohler, Timothy A., Scott G. Ortman, K. Grundtisch, C. Fitzpatrick, and S. Cole
2014 The Better Angels of Their Nature: Declining Violence through Time among Prehispanic Farmers of the Pueblo Southwest. *American Antiquity* 79:444–464.

Kosse, Krisztina
1990 Group Size and Societal Complexity: Thresholds in the Long-Term Memory. *Journal of Anthropological Archaeology* 9:275-303.

Kowalewski Stephen A.
2006 Coalescent Societies. In, *Light on the Path: Anthropology and History of the Southeastern Indians*, edited by T.J. Pluckhahn and R. Ethridge, pp. 94-122. University of Alabama Press, Tuscaloosa.

2013 The Work of Making Community. In *From Prehistoric Villages to Cities: Settlement Aggregation and Community Transformation*, edited by Jennifer Birch, pp. 201-218. Routledge, New York.

Kuijt, Ian
2000 People and Space in Early Agricultural Villages: Exploring Daily Lives, Community Size, and Architecture in the Late Pre-Pottery Neolithic. *Journal of Anthropological Archaeology* 19:75–102.

Lalonde, Marc P.
1992 Deciphering a Meal Again, or the Anthropology of Taste. *Social Science Information* 31:69–86.

Lanner, R. M.
1981 *The piñon pine: a natural and cultural history*. University of Nevada Press, Nevada.

Lave, Jean and Etienne Wenger
1991 *Situated Learning: Legitimate Peripheral Participation*. Cambridge University Press, Cambridge.

LeBlanc, Steven A.
1989 Cibola: Shifting Cultural Boundaries. In *Dynamics of Southwest Prehistory*, edited by Linda S. Cordell and George J. Gumerman, pp. 337–370. Smithsonian Institution, Washington, D.C.

1999 *Prehistoric Warfare in the American Southwest*. Anthropological Papers, 1. National Park Service, US Department of the Interior, Washington, D.C.

2001 Warfare and Aggregation in the El Morro Valley, New Mexico. In *Deadly Landscapes: Case Studies in Prehistoric Southwestern Warfare*, edited Glen E. Rice and Steven A. LeBlanc, pp. 19–50. University of Utah Press, Salt Lake City.

Lesure, Richard G.
1998 Vessel Form and Function in an Early Formative Ceramic Assemblage from Coastal Mexico. *Journal of Field Archaeology* 25:19-36.

Lévi-Strauss, Claude
1966 The Culinary Triangle. *Partisan Review* 33:586–595.

Lewis, Courtney
2018 Frybread Wars: Biopolitics and the Consequences of Selective United States Healthcare Practices for American Indians. *Food, Culture & Society* 21:427–448.

Lightfoot, Kent G.
1979 Food Redistribution among Prehistoric Pueblo Groups. *Kiva* 44:319–339.

Lightfoot, Kent G., Antoinette Martinez, and Ann M. Schiff
1998 Daily Practice and Material Culture in Pluralistic Social Settings: An Archaeological Study of Culture Change and Persistence from Fort Ross, California. *American Antiquity* 63:199–222.

Lindauer, Owen
2000 A Schoolhouse Point perspective on Salado community development. In *Salado* edited by J.S. Dean, pp. 219-240. University of New Mexico Press, Albuquerque.

Lippmeier, Heidi S.
1994 Faunal and Shell Remains. In *Archaeological Data Recovery Excavations at the Sanders Great House and Six Other Sites Along US Highway 191 South of Sanders, Apache County, Arizona*, edited by Thomas F. Fletcher, pp. 465–490. Zuni Archaeology Program Report No. 471, 9. Zuni Archaeology Program, Zuni.

Logan, Amanda L.
2012 History of Food Without History: Food Trade and Environment in West-Central Ghana in the Second Millennium AD. Unpublished PhD Dissertation, University of Michigan.

Logan, Amanda L. and Dores M. Cruz
2014 Gendered Taskscapes-Food, Farming, and Craft Production in Banda, Ghana in the Eighteenth to Twenty-First Centuries. *African Archaeological Review* 31:203–231.

Logan, Amanda L. and Ann B. Stahl
2017 Genealogies of Practice in and of the Environment in Banda, Ghana. *Journal of Archaeological Method and Theory* 24:1356–1399.

Longacre, William A.
1964 A Synthesis of Upper Little Colorado Prehistory. In *Chapters in the Prehistory of Eastern Arizona II*, edited by Paul S. Martin, John B. Rinaldo, William A. Longacre, Leslie G. Freeman Jr., James A. Brown, Richard H. Hevly, and M.E. Cooley, pp. 201–215. Fieldiana Anthropology, 55. Field Museum of Natural History, Chicago.

Longacre, William A., Sally. J. Holbrook, and Michael W. Graves (editors)
1982 *Multidisciplinary Research at Grasshopper Pueblo Arizona*. Anthropological Papers No. 40. University of Arizona Press, Tucson.

Lowell, Julie C
1991 Reflections of Sex Roles in the Archaeological Record: Insights from Hopi and Zuni Ethnographic Data. In *The Archaeology of Gender*, edited by Dale Walde and Noreen D. Willows, pp. 452-461. University of Calgary Archaeological Association, Calgary.

1995 Illuminating Fire-Feature Variability in the Grasshopper Region of Arizona. *Kiva* 60:351–369.

1996 Moieties in Prehistory: A Case Study from the Pueblo Southwest. *Journal of Field Archaeology* 23:77–90.

1999 The Fires of Grasshopper: Enlightening Transformations in Subsistence Practices through Fire-Feature Analysis. *Journal of Anthropological Archaeology* 18:441–470.

Lyman, R. Lee.
2008 *Quantitative paleozoology*. Cambridge University Press, Cambridge.

Macbeth, H. (editor)
1997 *Food Preferences and Taste: Continuity and Change*. Berghahn Books, Providence.

Macbeth, H. and Sue Lawry
1997 Food Preferences and Taste an Introduction. In *Food Preferences and Taste: Continuity and Change*, edited by H. Macbeth, pp. 1-14. Berghahn Books, Providence.

Mahoney, Nancy, Andrew I. Duff, and Keith W Kintigh
1995 The Role of Chacoan Outliers in Local Organization. Presented at the 60th Annual Meeting of the Society for American Archaeology, Minneapolis.

Martin, A. C. and W. D. Barkley
1961 *Seed Identification Manual*. University of California Press, Berkeley.

Martin, Paul S., John B. Rinaldo, John B. Bluhm, and Hugh C. Cutler
1956 *Higgins Flat Pueblo, Western New Mexico*. Fieldiana: Anthropology vol.45. Chicago Natural History Museum, Chicago.

Martin, Paul S., John B. Rinaldo and Eloise R. Barter
1957 *Late Mogollon Communities: Four Sites of the Tularosa Phase, Western New Mexico*. Fieldiana: Anthropology vol.49(1). Chicago Natural History Museum, Chicago.

Martin, Paul S. and John B. Rinaldo
1960 *Table Rock Pueblo Arizona.* Fieldiana, Anthropology Vol. 51 (no. 2), Chicago Natural History Museum.

Martin, Paul S., John B. Rinaldo, and William A. Longacre
1961 *Mineral Creek Site and Hooper Ranch Pueblo Eastern Arizona* Fieldiana: Anthropology vol.52. Chicago Natural History Museum, Chicago.

Martin, Paul S., John B. Rinaldo, William A. Longacre, Constance Cronin, Leslie G. Freeman Jr., and James Schoenwetter
1962 *Chapters in the Prehistory of Eastern Arizona, I*, Fieldiana Anthropology Vol. 53. Chicago Natural History Museum, Chicago.

Martin, Paul S., John B. Rinaldo, William A. Longacre, Leslie G. Freeman Jr., James A. Brown, Richard H. Hevly, and M.E. Cooley
1964 *Chapters in the Prehistory of Eastern Arizona, II*, Fieldiana: Anthropology Vol. 55. Field Museum of Natural History, Chicago

Martin, Paul S., William A. Longacre, and James N. Hill
1967 *Chapters in the Prehistory of Eastern Arizona, III*, Fieldiana: Anthropology Vol. 57. Field Museum of Natural History, Chicago.

Martin, Paul S.
n.d. Southwestern United States Archaeological Expeditions, Arizona State Museum Papers, 1929, 1934-1974. Field Museum Library Archives, Chicago.

Martínez, Natalia and Karen R. Adams
2008 Archaeological Maize: A Re-Assessment of Traits Relevant to Distinguishing Varieties. Poster presented at the 73rd Annual Meeting of the Society for American Archaeology, Vancouver, British Columbia, Canada.

Matson, R.G.
2016 The Nutritional Context of the Pueblo III Depopulation of the Northern San Juan: Too Much Maize? *Journal of Archaeological Science* 5:622–631.

Mauss, Marcel
1973 [1934] Techniques of the body. *Economy and Society* 2:70-88.

1980 [1925] *The Gift: Forms and Function of Exchange in Archaic Societies*. Routledge and Kegan Paul, London.

McBride, Pamela

2004 Paleoethnobotanical Analysis. In *To Command and Carry the Waters: An Archaeological Inventory and Analysis of the Excavations at* K'Yawa:Na'a Deyatchinanne *(NM:12:K3:392) Zuni, New Mexico,* edited by Jonathan Damp and Jeffery Waseta, pp. 201–212. Zuni Cultural Resource Enterprise Report, 670. Zuni Cultural Resource Enterprise, Zuni.

McFarlane, T. and P. Pliner

1997 Increasing willingness to taste novel foods: effects of nutrition and taste information. *Appetite* 28:23-29.

McGuire, Randall H. and Dean J. Saitta

1996 Although They Have Petty Captains, They Obey Them Badly: The Dialectics of Prehispanic Western Pueblo Social Organization. *American Antiquity* 61:197–216.

Meals for Millions/Freedom from Hunger Foundation

1980 *O'odham I:waki, Wild Green of the Desert People*. Meals for Millions/Freedom from Hunger Foundation, Tucson.

Meigs, Anna

1988 Food as a Cultural Construction. *Food and Foodways* 2:341–357.

Meyers, Norman and Jennifer Kent

2003 New Consumers: The Influence of Affluence on the Environment. *Proceedings of the National Academy of Sciences* 100:4963–4968.

Mihesuah, Devon

2016 Indigenous Health Initiatives, Frybread, and the Marketing of Nontraditional "Traditional" American Indian Foods. *Native American and Indigenous Studies* 3:45–69.

Miksicek, Charles H.

n.d. Plant Remains from the Cibola Archaeological Research Project. Manuscript on file, School of Human Evolution and Social Change, Arizona State University, Tempe.

Miller, Mack L. and Kermit Larson

1975 *Soil Survey of Apache County, Arizona, Central Part*. U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C.

Miller, Naomi F

1988 Ratios in Paleoethnobotanical Analysis. In *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains,* edited by Christine A. Hastorf , Virginia S. Popper, pp. 72–85. University of Chicago Press, Chicago.

Mills, Barbara J.
1999 Ceramics and the Social Contexts of Food Consumption in the Northern Southwest. In *Pottery and People*, edited by Skibo, James and Gary M. Feinman, pp. 99-114. University of Utah Press, Salt Lake.

2007a Performing the Feast: Visual Displays and Suprahousehold Commensalism in the Puebloan Southwest. *American Antiquity* 72:210-239.

2007b A Regional Perspective on Ceramics and Zuni Identity, A.D. 2000-1630. In *Zuni Origins: Toward a New Synthesis of Southwestern Archaeology*, edited by D.A. Gregory and D.R. Wilcox, pp. 210–238. University of Arizona Press, Tucson.

2008 Colonialism and Cuisine. In *Cultural Transmission and Material Culture: Breaking Down Boundaries*, edited by Miriam T. Stark, Brenda J. Bowser, and Lee Horne, pp. 245–265. The University of Arizona Press, Tucson.

2016 Communities of Consumption: Cuisines as Constellated Networks of Situated Practice. In *Knowledge in Motion: Constellations of Learning across Time and Place*, edited by Andrew P. Roddick and Ann B. Stahl, pp. 247–270. University of Arizona Press, Tucson.

Mills, Barbara J., Sarah A. Herr, and Scott Van Keuren (editors)
1999 *Living on the Edge of the Rim: Excavations and Analysis of the Silver Creek Archaeological Research Project, 1993-1998*. Arizona State Museum Archaeological Series No. 192. University of Arizona, Tucson.

Mills, Barbara J., Jeffery J. Clark, Matthew A. Peeples, W. Randall Haas Jr., John M. Roberts Jr., Brett J. Hill, Deborah L. Huntley, Lewis Borck, Ronald L. Breiger, Aaron Clauset, and Steven M. Shackley.
2013 Transformation of Social Networks in the Late Pre-Hispanic US Southwest. *Proceedings of the National Academy of Sciences* 110:5785–5790.

Mills, Barbara J., Matthew A. Peeples, W. Randall Haas Jr., Lewis Borck, Jeffery J. Clark, and John M Roberts Jr.
2015 Multiscalar Perspectives on Social Networks in the Late Prehispanic Southwest. *American Antiquity* 80:3-24.

Mindeleff, Victor
1989 *A Study of Pueblo Architecture in Tusayan and Cibola. Smithsonian Institution*, Washington, D.C.

Minnis, Paul E.
1981 Seeds in Archaeological Sites: Sources and Some Interpretive Problems. *American Antiquity* 46:143–152.

1985 *Social Adaptation to Food Stress: A Prehistoric Southwestern Example*. University of Chicago Press, Chicago.

1989 Prehistoric Diet in the Northern Southwest: Macroplant Remains from Four Corners Feces. *American Antiquity* 54:543–563.

Mintz, Sidney W.
1985 *Sweetness and Power: The Place of Sugar in Modern History*, Penguin, New York.

1996 *Tasting food, tasting freedom*. Beacon Press, Boston.

Mintz, Sidney W. and Christine M. Du Bois
2002 The Anthropology of Food and Eating. *Annual Review of Anthropology* 31: 99-119.

Miracle, Preston and Nicky Milner (editors)
2002 *Consuming passions and patterns of consumption*. McDonald Institute for Archaeological Research, Cambridge.

Moerman, Daniel E.
2003 Native American ethnobotany. A database of foods, drugs, dyes and fibers of Native American peoples, derived from plants. Electronic document, http://herb.umd.umich.edu/, accessed 22 March 2016.

Morehart, Christopher T. and Dan T.A. Eisenberg
2010 Prosperity, Power, and Change: Modeling Maize at Postclassic Xaltocan, Mexico. *Journal of Anthropological Archaeology* 29:94–112.

Morehart, Christopher T., De Lucia (editors)
2015 *Surplus: The Politics of Production and the Strategies of Everyday Life*. University Press of Colorado, Boulder.

Mueller, Jennifer L.
2006 Ritual Feasting and Trajectories to Social Power in a Southern Chacoan Great House Community. Unpublished MA Thesis, Washington State University.

Muenchrath, Deborah A., Maya Kuratomi, Jonathan A. Sandor, and Jeffrey A. Homburg
2002 Observational Study of Maize Production Systems of Zuni Farmers in Semiarid New Mexico. *Journal of Ethnobiology* 22:1–33.

Murdock, George P. and Caterina Provost
1973 Measurement of cultural complexity. *Ethnology* 12:379– 392.

Museum of Northern Arizona Notes
n.d. Museum of Northern Arizona Archives. Museum of Northern Arizona, Flagstaff.

Nelson, Ben A.
1981 Ethnoarchaeology and Paleodemography: A Test of Turner and Lofgren's Hypothesis. *Journal of Anthropological Research* 37:107–129.

Nelson, Margaret C., Keith W Kintigh, David R. Abbott, and John M. Anderies
2010 The Cross-Scale Interplay between Social and Biophysical Context and the Vulnerability of Irrigation-Dependent Societies: Archaeology's Long-Term Perspective. *Ecology and Society* 15:31.

Nelson, Margaret C., Michelle Hegmon, Stephanie R. Kulow, Matthew A. Peeples, Keith W. Kintigh, and Ann P. Kinzig
2011 Resisting Diversity: A Long-Term Archaeological Study. *Ecology and Society* 16:25.

Nelson, Margaret C., Scott E. Ingram, Andrew J. Dugmore, Richard Streeter, Matthew A. Peeples, Thomas H. McGovern, Michelle Hegmon, Jette Arneborg, Keith W. Kintigh, Seth Brewington, Katherine A. Spielmann, Ian A. Simpson, Colleen Strawhacker, Laura E.L. Comeau, Andrea Torvinen, Christian K. Madsen, George Hambrecht, and Konrad Smiarowski
2015 Climate Challenges, Vulnerabilities, and Food Security. *Proceedings of the National Academy of Sciences* 113:298–303.

Nixon-Darcus, Laurie and A. Catherine D'Andrea
2017 Necessary for Life: Studies of Ancient and Modern Grinding Stones in Highland Ethiopia. *African Archaeological Review* 34:193–223.

Norton, Jay B., Jonathan A. Sandor, and C.S. White
2003 Hillslope Soils and Organic Matter Dynamics within a Native American Agroecosystem on the Colorado Plateau. *Soil Science Society of America Journal* 67:225–234.

Oas, Sarah E.
2016a CARP Macrobotanical Database (tDAR id: 405543); doi:10.6067/XCV8SF3009

2016b EMVPP Macrobotanical Database (tDAR id: 405545); doi:10.6067/XCV8JW8HPV

2016c OBAP Macrobotanical Database (tDAR id: 405547); doi:10.6067/XCV8KW5JT

2017a Cibola Plant Remains Macrobotanical Database (tDAR id: 440626); doi:10.6067/XCV82V2JXJ

2017b RCAP Macrobotanical Database (tDAR id: 440614); doi:10.6067/XCV8X63QSZ

2017c ULCPP Macrobotanical Database (tDAR id: 440624); doi:10.6067/XCV85Q4ZW6

Oas, Sarah E., A. Catherine D'Andrea, and Derek J. Watson
2015 10,000 Year History of Plant Use at Bosumpra Cave, Ghana. *Vegetation History and Archaeobotany* 24: 635–653.

Oas, Sarah E. and Mark Hauser
2017 The Political Ecology of Plantations from the Ground Up. *Environmental Archaeology* 23:4-12.

OBAP
1998 Ojo Bonito Archaeological Project Fauna. (tDAR id: 420); doi:10.6067/XCV8Q81B1X

OBAP notes
n.d. Ojo Bonito Archaeological Project Archives. School of Human Evolution and Social Change, Arizona State University, Tempe, AZ.

Ohnuki-Tierney, Emiko
1993 *Rice as Self: Japanese Identities through Time*. Princeton University Press, Princeton.

Olsen, John W.
1990 *Vertebrate Faunal Remains from Grasshopper Pueblo Arizona*. Anthropological Papers of the Museum of Anthropology, 83. University of Michigan, Ann Arbor.

Ortman, Scott G.
1998 Corn Grinding and Community Organization in the Pueblo Southwest, A.D. 1150-1550. In *Migration and Reorganization: The Pueblo IV Period in the American Southwest*, edited by K.A. Spielmann, pp. 165-192. Anthropological Research Papers No. 51. Arizona State University, Tempe.

2000 Artifacts. In *The Archaeology of Castle Rock Pueblo, a Thirteenth Century Village in Southwestern Colorado*, edited by Kristen A. Kuckelman. Electronic document, http://crowcanyon.org/castlerock, accessed October 28, 2016.

2012 *Winds from the North: Tewa Origins and Historical Anthropology*. The University of Utah Press, Salt Lake City.

Ortman, Scott G. and Bruce A. Bradley
2002 Sand Canyon Pueblo: The Container in the Center Place. In *Seeking the Center Place: Archaeology and Ancient Communities in the Mesa Verde Region*, edited by Mark D. Varien, Richard H. Wilshusen, pp. 41–78. University of Utah Press, Salt Lake City.

Ortman, Scott G., Andrew H.F. Cabaniss, Jennie O. Sturm, and Luis M.A. Bettencourt
2014 The Pre-History of Urban Scaling. *PLoS ONE 9:1–10.*

Ortman, Scott G., Andrew H.F. Cabaniss, Jennie O. Sturm, and Luis M.A. Bettencourt
2015 Settlement Scaling and Increasing Returns in an Ancient Society. *Science Advances* 1:1–8.

Ortman, Scott G., Kaitlyn E. Davis, Jose Lobo, Michael E. Smith, Julio L. Betancourt, and Aaron Trumbo
2016 Settlement Scaling and Economic Change in the Central Andes. *Journal of Archaeological Science* 73:94–106.

Ortman, Scott G. and Grant Coffey
2017 Settlement Scaling in Middle-Range Societies. *American Antiquity* 84: 662–682.

Parsons, Elsie Clews
1939 *Pueblo Indian Religion*. University of Chicago Press, Chicago.

Pauketat, Timothy R.
2001 Practice and history in archaeology. *Anthropological Theory* 1:73-98.

Pearsall, Deborah M.
1973 Prehistoric Settlement and Adaptation in the Ramah Valley, New Mexico. Unpublished Honors Thesis, University of Michigan, Ann Arbor.

2015 *Paleoethnobotany: A Handbook of Procedures* 3rd edition. Left Coast Press, Walnut Creek.

Peeples, Matthew A.
2011 Identity and Social Transformation in the Prehispanic Cibola World: A.D. 1150-1325. Unpublished PhD Dissertation, Arizona State University, Tempe.

2018 *Connected Communities: Networks, Identity, and Social Change in the Ancient Cibola World*. University of Arizona Press, Tucson.

n.d. An Experimental Method for Estimating Vessel Volume based on Body Sherds. Manuscript on file, School of Human Evolution and Social Change, Arizona State University.

Peeples, Matthew A. and Gregson Schachner
2012 Refining Correspondence Analysis-Based Ceramic Seriation of Regional Data Sets. *Journal of Archaeological Science* 39:2818–2827.

Peeples, Matthew A., Gregson Schachner, and Edgar K. Huber
2012 Rethinking Pithouse Communities across the Greater Zuni Region. In *Southwestern Pithouse Communities, AD 200-900*, edited by Lisa C. Young and Sarah A. Herr, pp. 166–180. University of Arizona Press, Tucson.

Peeples, Mathew A. and W. Randall Hass Jr.
2013 Brokerage and Social Capital in the Prehispanic U.S. Southwest. *American Anthropologist* 115:232–247.

Peeples, Matthew A., Gregson Schachner, and Keith W Kintigh
2017 The Zuni/ Cibola Region. In *The Oxford Handbook of Southwest Archaeology*, edited by Barbara J. Mills and Severin Fowles, pp. 445–460. Oxford University Press, New York.

Peregrine, Peter N.
2001 Matrilocality, Corporate Strategy, and the Organization of Production in the Chacoan World. *American Antiquity* 66:36–46.

Pierce, Christopher Dion
1999 Explaining Corrugated Pottery in the American Southwest: An Evolutionary Approach. Unpublished PhD Dissertation, University of Washington, Seattle.

Pliner, P. and C. Stallberg-White
2000 "Pass the Ketchup, Please": Familiar Flavors Increase Children's Willingness to Taste Novel Foods. *Appetite* 34:95–103.

Polanyi, Karl
1957 The Economy as Instituted Process. In *Trade and Market in the Early Empires: Economies in History and Theory*, edited by K. Polanyi, A. C. and H. Pearson, pp. 243-270. Free Press, New York.

Pollock, Susan
2012 Towards an Archaeology of Commensal Spaces. *ETopoi Journal for Ancient Studies*:1–20.

2013 Commensality, Public Spheres, and *Handlungsräume* in Ancient Mesopotamia. In *Big Histories, Human Lives: Tackling Problems of Scale in Archaeology*, edited by John Robb and Timothy R. Pauketat, pp. 145-170. School for Advanced Research Press, Santa Fe.

Popper, Virginia S

1988 Selecting Quantitative Measurements in Paleoethnobotany. In C*urrent Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*, edited by Christine A. Hastorf and Virginia S. Popper, pp. 53–71. University of Chicago Press, Chicago.

Potter, James M.

1997a Communal Ritual, Feasting, and Social Differentiation in Late Prehistoric Zuni Communities. Unpublished PhD Dissertation, Arizona State University, Tempe.

1997b Communal Ritual and Faunal Remains: An Example from the Dolores Anasazi. *Journal of Field Archaeology* 24:353–364.

2000 Pots, Parties, and Politics: Communal Feasting in the American Southwest. *American Antiquity* 65:471–492.

2004 The Creation of Person, the Creation of Place: Hunting Landscapes in the American Southwest. *American Antiquity* 69:322–338.

Potter, James M. and Elizabeth M. Perry

2000 Ritual as a Power Resource in the American Southwest. In *Alternative Leadership Strategies in the Prehispanic Southwest*, edited by Barbara J. Mills, pp. 60–78. University of Arizona Press, Tucson.

Potter, James M. and Scott G. Ortman.

2004 Community and Cuisine in the Prehispanic American Southwest. In *Identity, Feasting, and the Archaeology of the Greater Southwest* edited by Barbara J. Mills, pp.173-191. University Press, of Colorado, Boulder.

Powers, William K. and Marla M.N. Powers

1984 Metaphysical Aspects of an Oglala Food System. In *Food in the Social Order: Studies of Food and Festivities in Three American Communities*, edited by Mary Douglas, pp. 40–96. Russell Sage Foundation, New York.

Prevost, Deborah J. Fred Bowannie, and Jr., Andrew Laahty

1993 Soils in Zuni rainfall runoff fields. *Zuni Farming for Today and Tomorrow* No.2: 8-9. Occasional Newsletter of the Zuni Sustainable Agriculture Project and the Zuni Folk Varieties Project, Zuni.

Price, T. Douglas and Gary M. Feinman (editors)

2010 *Pathways to Power: New Perspectives on the Emergence of Social Inequality*. Springer, New York.

Proust, Marcel
1934 *Remembrance of Things Past*. Translated by C.K. Scott- Moncrieff. Random House, New York.

Raily, Jim A.
2008 *Hokona: A Pueblo III-IV Settlement on NM 53 Near El Morro (Cibola County), New Mexico. NMDOT Cultural Resource Technical Series, 2007–2*. New Mexico Department of Transportation, Santa Fe.

Rappaport, Roy A.
1968 *Pigs for the Ancestors: Ritual in the Ecology of a New Guinea People* (enlarged edition*)*. Yale University, New Haven.

Rautman, Alison E.
2013 Social Integration and the Built Environment of Aggregated Communities in the North American Puebloan Southwest. In *From Prehistoric Villages to Cities: Settlement Aggregation and Community Transformation*, edited by Jennifer Birch, pp. 111–133. Routledge, New York.

Reitz, Elizabeth J. and Elizabeth S. Wing.
1999 *Zooarchaeology*. Cambridge University Press, Cambridge.

Richards, Audrey I.
1939 *Land, Labour, and Diet in Northern Rhodesia, an Economic Study of the Bemba Tribe*. Oxford University Press, London.

Ritzenthaler, Robert E.
1966 Piki Bread of the Hopi Indians of Arizona. *Lore* 16:102–105.

Roberts, Frank H. Jr.
1932 *The Village of the Great Kivas on the Zuni Reservation, New Mexico*. Bureau of American Ethnology Bulletin, 111. Smithsonian Institution, Washington, D.C.

1939 *Archaeological Remains in the Whitewater District, Eastern Arizona: Part I, House Types*. Bureau of American Ethnology Bulletin, 121. Smithsonian Institution, Washington, D.C.

Robbins, Wilfred William, John Peabody Harrington, and Barbara Freire-Marreco
1916 *Ethnobotany of the Tewa Indians*. Bureau of American Ethnology Bulletin 55. Smithsonian Institution, Washington D.C.

Rogers, R.N.
1980 The Chemistry of Pottery Smudging. *Pottery Southwest* 7:2–4.

Rothschild, Nan A. and Susan A. Dublin (editors)
1995 *The Zuni Farming Village Study and Excavations at Lower Pescado Village: A Report on the Columbia/Barnard Archaeological Field School, 1989-1991,* edited by Nan A. Rothschilde and Susan A. Dublin. Submitted to Pueblo of Zuni, Zuni.

Rozin, Elisabeth
1973 *The Flavor-Principle Cookbook*. Hawthorne, New York.

1992 *Ethnic Cuisine: How to Create the Authentic Flavors of 30 International Cuisines*. Penguin Books, New York.

Rozin, Paul
1978 The Use of Characteristic Flavorings in Human Culinary Practice. In *Flavor: Its Chemical, Behavioral, and Commercial Aspects*, edited by C.M. Apt, pp. 57–81. Westview Press, Boulder.

1984 The Acquisition of Food Habits and Preferences. In *Behavioral Health : A Handbook of Health Enhancement and Disease Prevention*, edited by J.D. Matarazzo, S.M. Weiss, J.A. Herd, and N.E. Miller, pp. 590–607. John Wiley, New York.

Rude, Trisha J. and Karen R. Adams
2006 Plant Remains from the Yamutewa and Ponchuella Residences, Zuni Middle Village. Presented at the Colonialism and Culture Change at Zuni Pueblo, 1300-Present, Amerind Foundation Advanced Seminar, Dragoon.

Ruppe, P.A.
1987 Analysis of Macrobotanical Remains from N:12:K3:4. In *Survey, Testing, and Excavation Along New Mexico State Highway 53, Between the Black Rock Cutoff Road and the Nutria Road, Zuni Indian Reservation, McKinley County*, edited by Mark D. Varien, pp. 158–182. Zuni Archaeology Program Report, 232. Zuni Archaeology Program, Zuni.

Sahlins, Marshall
1972 *Stone Age Economics*. Aldine, Chicago.

Saitta, Dean J.
1991 Room Use and Community Organization at the Pettit Site, West Central New Mexico. *Kiva* 56:385-409.

1994 The Political Economy and Ideology of Early Population Aggregation In Togeye Canyon, AD 1150-1250. In *Exploring Social, Political and Economic Organization in the Zuni Region*, edited by Todd L. Howell and Tammy Stone, pp. 58–79. Anthropological Research Papers, 46. Arizona State University, Tempe.

Saitta, Dean J. and Arthur S. Keene
1990 Politics and Surplus Flow in Prehistoric Communal Societies. In *The Evolution of Political Systems: Sociopolitics in Small-Scale Sedentary Societies*, edited by Steadman Upham, pp. 203–224. Cambridge University Press, Cambridge.

Salaman, R.N. and W.G. Burton
1985 *History and Social Influence of the Potato*. Cambridge University Press, Cambridge.

Schachner, Gregson
2010 Corporate Group Formation and Differentiation in Early Puebloan Villages of the American Southwest. *American Antiquity* 75:473–496.

2012 *Population Circulation and the Transformation of Ancient Zuni Communities*. University of Arizona Press, Tucson.

Schachner, Gregson, Deborah L. Huntley, and Andrew I. Duff
2011 Changes in Regional Organization and Mobility in the Zuni Region of the American Southwest during the Pueblo III and IV Periods: Insights from INAA Studies. *Journal of Archaeological Science* 38:2261–2273.

Schiffer, Michael B.
1990 The Influence of Surface Treatment on Heating Effectiveness of Ceramic Vessels. *Journal of Archaeological Science* 17:373-381.

Schiffer, Michael B. and James M. Skibo
1987 Theory and Experiment in the Study of Technological Change. *Current Anthropology* 28:595–622.

Schiffer, Michael B., James M. Skibo, Tamara C. Boelke, Mark A. Neupert, and Meredith Aronson
1994 New Perspectives on Experimental Archaeology: Surface Treatments and Thermal Response of the Clay Cooking Pot. *American Antiquity* 59:197-217.

Schoenwetter, James
1992 Notes on Hinkson Site Palynology (tDAR id: 6279) ; doi:10.6067/XCV880510M

Schollmeyer, Karen Gust and Jonathan C. Driver
2013 Settlement Patterns, Source–Sink Dynamics, and Artiodactyl Hunting in the Prehistoric U.S. Southwest. *Journal of Archaeological Method and Theory* 20:448–478.

Searcy, Michael T.
2011 *The Life-Giving Stone: Ethnoarchaeology of Maya Metates*. University of Arizona Press, Tucson.

Senior, Louise M. and Linda J. Pierce
1989 Turkeys and Domestication in the Southwest: Implications from Homol'ovi III. *Kiva* 54:245–259.

Sinensky, R. J. and Alan Farahani
2018 Diversity-Disturbance Relationships in the Late Archaic Southwest: Implications for Forager-Farmer Foodways. *American Antiquity* 82:281-301.

Siskind, J.
1992 The Invention of Thanksgiving: A Ritual of American Nationality. *Critique of Anthropology* 12:167–191.

Skibo, James M.
1992 *Pottery Function: A Use-Alteration Perspective*. New York: Plenum Press.

Smith, Monica L. (editor)
2017 *Abundance: The Archaeology of Plenitude*. University Press of Colorado, Boulder.

Smith, Janell and Dennis Wiedman
2001 Fat Content of South Florida Indian Frybread: Health Implications for a Pervasive Native-American Food. *Journal of the American Dietetic Association* 101:582–585.

Smith, Monica L.
2006 The Archaeology of Food Preference. *American Anthropologist* 108:480–493.

2015 Feasts and Their Failures. *Journal of Archaeological Method and Theory* 22:1215–1237.

Smith, Susan J.
2003 Preliminary Pollen Results from Zuni Pueblo Middle Village Excavations. Presented at the Colonialism and Culture Change at Zuni Pueblo, 1300-Present, Amerind Foundation Advanced Seminar, Dragoon.

Smith, Watson
1973 *The Williams Site: A Frontier Mogollon Village in West-Central New Mexico*. Papers of the Peabody Museum of American Archaeology and Ethnology Vol. 39, No. 2. Harvard University, Cambridge.

Smith, Watson, Richard B. Woodbury, and Nathalie F. Woodbury

1966 *The Excavation of Hawikuh by Frederick Webb Hodge, Report of the Hendricks-Hodge Expedition, 1917-1923*. Contributions from the Museum of the American Indian Heye Foundation, Vol. XX. Museum of the American Indian Heye Foundation, New York.

Snow, David H.

1990 *Tener Comal y Metate*: Protohistoric Rio Grande Maize Use and Diet. In *Perspectives on Southwestern Prehistory*, edited by Paul E. Minnis and Charles L. Redman, pp. 289–300. Westview Press, Boulder.

Speller, Camilla F., Brian M. Kemp, Scott D. Wyatt, Cara Monroe, William D. Lipe, Ursula M. Arndt, and Dongya Y. Yang

2010 Ancient Mitochondrial DNA Analysis Reveals Complexity of Indigenous North American Turkey Domestication. *Proceedings of the National Academy of Sciences* 107:2807–2812.

Sobolik, Kristin D., Lauria S. Zimmerman, and Brooke Manross Guilfoyl

1997 Indoor versus Outdoor Firepit Usage: A Case Study from the Mimbres. *Kiva* 62:283-300.

Spencer, Victoria and Marlene Sekaquaptewa

1995 Piki of the Hopi Indians. *Expedition* 37:19–24.

Spielmann, Katherine A. (editor)

1998a *Migration and Reorganization: The Pueblo IV Period in the American Southwest.* Anthropological Research Papers, 51. Arizona State University, Tempe.

Spielmann, Katherine A.

1995 Glimpses of Gender in the Prehistoric Southwest. *Journal of Anthropological Research* 51:91–102.

1998b Ritual Influences on the Development of Rio Grande Glaze A Ceramics. In *Migration and Reorganization: The Pueblo IV Period in the American Southwest*, edited by Katherine A. Spielmann, pp. 253–262. Anthropological Research Papers, 51. Arizona State University, Tempe.

2002 Feasting, Craft Specialization, and the Ritual Mode of Production in Small-Scale Societies. *American Anthropologist* 1:195-207.

2004 Communal Feasting, Ceramics, and Exchange. In, *Identity, Feasting, and the Archaeology of the Greater Southwest*, edited by Barbara J. Mills, pp. 210-232. University of Arizona Press, Tucson.

Spielmann, Katherine A. and Eric A. Angstadt-Leto
1996 Hunting, Gathering, and Health in the Prehistoric Southwest. In *Evolving Complexity and Environmental Risk in the Prehistoric Southwest*, edited by Joseph A. Tainter and Bonnie B. Tainter, pp. 79–106. Addison-Wesley, Reading.

Spielmann, Katherine A., Tiffany Clark, Diane Hawkey, Katharine Rainey, and Suzanne K. Fish
2009 "...Being Weary, They Had Rebelled": Pueblo Subsistence and Labor under Spanish Colonialism. *Journal of Anthropological Archaeology* 28: 102–125.

Spier, Leslie
1917 *An Outline for a Chronology of Zuni Ruins*. Anthropological Papers of the American Museum of Natural History No. 18, part 3. American Museum of Natural History, New York.

Stafford, C. Russell, Glen E. Rice
1980 *Studies in the Prehistory of the Forestdale Region, Arizona. Anthropological Field Studies No.1*. Office of Cultural Resource Management Department of Anthropology, Arizona State University, Tempe.

Stahl, Ann B.
2002 Colonial Entanglements and the Practices of Taste: An Alternative to Logocentric Approaches. *American Anthropologist* 104:827–845.

Stephen, Alexander M.
1936 *Hopi Journal of Alexander M. Stephen*, edited by Elsi Worthington Clews Parsons. Columbia University Contributions to Anthropology, vol. XXIII. Columbia University Press, New York.

Stevens, Chris J.
2003 An Investigation of Agricultural Consumption and Production Models for Prehistoric and Roman Britain. *Environmental Archaeology* 8:61–76.

Stevenson, Matilda C.
1904 *The Zuñi Indians: Their Mythology, Esoteric Fraternities, and Ceremonies*. Annual Report of the Bureau of American Ethnology, 1901-1902, 23. Smithsonian Institution, Washington, D.C.

1915 *Ethnobotany of the Zuni Indians*. Annual Report of the Bureau of American Ethnology, 1908-1909, 30. Washington Government Printing Office, Washington, D.C.

Stiger, Mark A.
1975 Anasazi Diet: The Coprolite Diet. Unpublished M.A. Thesis, University of Colorado.

Stone, Glenn Davis and Christian E. Downum
1999 Non-Boserupian Ecology and Agricultural Risk: Ethnic Politics and Land Control in the Arid Southwest. *American Anthropologist* 101:113–128.

Stone, Tammy
1991 Arizona State University Archaeological Field School, 1988 and 1990 Field Season Survey, Preliminary Report. Manuscript on file, School of Human Evolution and Social Change, Arizona State University, Tempe.

2000 Prehistoric Community Integration in the Point of Pines Region of Arizona. *Journal of Field Archaeology* 27:197-208.

2018 Smudged Wares: The Importance of Color and Iridescence as a Long-Lived Decorative Attribute in the Mogollon Highlands. *Kiva* 84:1–26.

Strathern, Andrew J.
1969 Finance and Production: Two Strategies in New Guinea Highlands Exchange Systems. *Oceania* 40:42-67.

Stratton, Susan K, Jerome Zunie, and Robert D. Leonard
2000 Faunal Remains from Oak Wash. In *The Archaeology and Ethnohistory of Oak Wash, Zuni Indian Reservation, New Mexico, Part 1*, edited by T.L. Howell, pp. 648–670. Zuni Cultural Resource Enterprise Report, 664. Zuni Cultural Resource Enterprise, Zuni.

Sutton, David E.
2001 *Remembrance of Repasts: An Anthropology of Food and Memory*. Berg, Oxford.

2010 Food and the Senses. *Annual Review of Anthropology*. 39:209-223.

Sutton, Mark Q. and Karl J. Reinhard
1995 Cluster Analysis of the Coprolites from Antelope House: Implications for Anasazi Diet and Cuisine. *Journal of Archaeological Science* 22:741–750.

Swarts, Kelly, Rafal M. Gutaker, Bruce Benz, Michael Blake, Robert Bukowski, James Holland, Melissa Kruse-Peeples, Nicholas Lepak, Lynda Prim, M. Clinta Romay, Jeffrey Ross-Ibarra, Jose de Jesus Sanchez-Gonzalez, Chris Schmidt, Verena J. Schuenemann, Johannes Krause, R.G. Matson, Detlef Weigel, Edward S. Buckler, and Hernám A. Burbano.
2017 Genomic estimation of complex traits reveals ancient maize adaptation to temperate North America. *Science* 357:512-515.

Swentzell, Roxanne and Patricia M. Perea (editors)
2016 *The Pueblo Food Experience Cookbook: Whole Food of Our Ancestors*. Museum of New Mexico Press, Santa Fe.

Szuter, Christine R.
1991 *Hunting by Prehistoric Horticulturalists in the American Southwest*. Garland Publishing, New York

Szuter, Christine R. and Frank H. Bayham
1989 Sedentism and Prehistoric Animal Procurement among Desert Horticulturalists of the North American Southwest. In *Farmers as Hunters: The Implications of Sedentism*, edited by S. Kent, pp. 80–95. Cambridge University Press, Cambridge.

Tawater , Art
2009 Faunal Analysis Techado Spring Pueblo. In T*echado Spring Pueblo: West-Central New Mexico*, edited by J.E.Smith II and L. Robertson, pp. 219–226. Special Publications, 3. LER & Sons, Dallas.

Thiel, Homer J.
1996 HARP Fauna (tDAR id: 1630) ; doi:10.6067/XCV86W98D0

Tilman, David and Michael Clark
2014 Global Diets Link Environmental Sustainability and Human Health. *Nature* 515:518–522.

Triadan, Daniela
1997 *Ceramic Commodities and Common Containers: Production and Distribution of White Mountain Red Ware in the Grasshopper Region, Arizona*. Anthropological Papers of the University of Arizona No. 61. University of Arizona Press, Tucson.

Turkon, Paula
2006 Morphological Variation of Maize Cupules and Access to High Quality Maize in the prehispanic Malpaso Valley, Zacatecas, Mexico. *Journal of Ethnobiology* 26:139-164.

2007 Food Preparation and Status in Mesoamerica. In *The Archaeology of Food and Identity*, edited by Katherine Twiss, pp. 152–170. Occasional Paper, 34. Southern Illinois University, Center for Archaeological Investigations, Carbondale.

Turner, Christy G. II and Laurel Lofgren
1966 Household Size of Prehistoric Western Pueblo Indians. *Journal of Anthropology* 22:117–132.

Twiss, Katheryn C. (editor)
2007 *The Archaeology of Food and Identity*, Occasional Paper, 34. Southern Illinois University, Center for Archaeological Investigations, Carbondale.

Twiss, Katheryn C.
2012 The Archaeology of Food and Social Diversity. *Journal of Archaeological Research* 20:357-395.

2015 Methodological and Definitional Issues in the Archaeology of Food. In *Commensality: From Everyday Food to Feast*, edited by Susanne Kerner, Cynthia Chou, and Morten Warmind, pp. 89–98. Bloomsbury, London.

Twiss, Katheryn C. and Amy Bogaard
2017 Coping with Abundance: The Challenges of a Good Thing. In *Abundance: The Archaeology of Plenitude*, edited by Monica L. Smith, pp. 165–179. University Press of Colorado, Boulder.

ULCPP notes
n.d. Upper Little Colorado Prehistory Project Archives. School of Human Evolution and Social Change, Arizona State University, Tempe.

University of Denver Museum of Anthropology Notes
n.d. Museum of Anthropology Archives. University of Denver Museum of Anthropology, Denver.

Van der Veen, Marjike,
2003 When is Food a Luxury? *World Archaeology* 34:405-427.

Van Keuren, Scott
2004 Crafting Feasts in the Prehispanic Southwest. In *Identity, Feasting, and the Archaeology of the Greater Southwest*, edited by Barbara J. Mills, pp. 192-209. University Press of Colorado, Boulder, CO.

Van West, Carla R. and David H. Greenwald
2005 Introduction and Background. In *Fence Lake Project: Archaeological Data Recovery in the New Mexico Transportation Corridor and First Five-Year Permit Area, Fence Lake Coal Mine Project, Catron County, New Mexico, Volume 1: Introduction and Site Descriptions*, edited by E.K. Huber and C.R. Van West, pp. 1.1-1.121. Technical Series No. 84. Statistical Research, Inc., Tucson.

Van West, Carla R. and Henri D. Grissino-Mayer
2005 Dendroclimatic Reconstruction. In *Fence Lake Project: Archaeological Data Recovery in the New Mexico Transportation Corridor and First Five-Year Permit Area, Fence Lake Coal Mine Project, Catron County, New Mexico, Volume 3: Environmental Studies*, edited by E.K. Huber and C.R. Van West, pp. 33.1-33.130. Technical Series No. 84. Statistical Research, Inc., Tucson.

VanDerwarker, Amber M., C. Margaret Scary, and Jane M. Eastman
2007 Menus for Families and Feasts: Household and Community Consumption of Plants at Upper Saratown, North Carolina. In *The Archaeology of Food and Identity*, edited by Katheryn C. Twiss, pp. 16–49. Occasional Paper, 34. Southern Illinois University, Center for Archaeological Investigations, Carbondale.

VanDerwarker, Amber M., Dana N. Bardolph, Kristin M. Hoppa, Heather B. Thakar, Lana S. Martin, Allison L. Jaqua, Matthew E. Biwer, and Kristina M. Gill
2016 New World Paleoethnobotany in the New Millennium (2000–2013). *Journal of Archaeological Research* 24:125–177.

VanDerwarker, Amber M. and Gregory D. Wilson
2016 War, Food, and Structural Violence in the Mississippian Central Illinois Valley. In, *The Archaeology of Food and Warfare*, edited by A.M. VanDerwarker and G.D. Wilson, pp. 75-105. Springer, Cham.

Vantrease, Dana
2013 Commod Bods and Frybread Power: Government Food Aid in American Indian Culture. *Journal of American Folklore* 126:55–69.

Varien, Mark D.
1987 *Survey, Testing, and Excavation Along New Mexico State Highway 53, Between the Black Rock Cutoff Road and the Nutria Road, Zuni Indian Reservation, McKinley County, New Mexico*. Zuni Archaeology Program Report No. 232, Zuni Archaeology Program Research Series No. 5. Zuni Archaeology Program, Zuni.

1990 *Excavations at Three Prehistoric Sites Along Pia Mesa Road, Zuni Indian Reservation, McKinley County, New Mexico*. Zuni Archaeology Program Report No. 233, Zuni, New Mexico. Zuni Archaeology Program, Zuni.

Varien, Mark D., James M. Potter, and Tito E. Naranjo
2017 Water, Wind, Breath Seeking Abundance in the Northern American Southwest. In *Abundance: The Archaeology of Plenitude,* edited by Monica L. Smith, pp. 65–94. University Press of Colorado, Boulder.

Vestal, Paul A.
1952 Ethnobotany of the Ramah Navajo. *Papers of the Peabody Museum of American Archaeology and Ethnology* 40:3-94.

Wandsnider, LuAnn
1997 The Roasted and the Boiled: Food Composition and Heat Treatment with Special Emphasis on Pit-Hearth Cooking. *Journal of Anthropological Archaeology* 16:1-48.

Warde, Alan

1997 *Consumption, Food and Taste*. Sage, London.

Watson, Patty Jo, Steven A. LeBlanc, and Charles L. Redman

1980 Aspects of Zuni Prehistory: Preliminary Report on Excavations and Survey in the El Morro Valley of New Mexico. *Journal of Field Archaeology* 7:201-218.

Webster, Laurie

1997 Effects of European Contact on Textile Production and Exchange in the Northern American Southwest: A Pueblo Case Study. Unpublished PhD Dissertation, University of Arizona.

Weismantel, Mary J.

1988 *Food, Gender, and Poverty in the Ecuadorian Andes*. University of Philadelphia Press, Philadelphia.

Welch, John R.

1996 The Archaeological Measures and Social Implications of Agricultural Commitment. Unpublished PhD dissertation, University of Arizona.

Westfall, Deborah A.

1981 *Prehistory of the St. Johns Area, East-Central Arizona: The TEP St. John's Project*. Archaeological Series No. 153. Arizona State Museum, Tucson.

Whiteley, Peter

1988 *Deliberate Acts: Changing Hopi Culture Through the Oraibi Split*. University of Arizona Press, Tucson.

Whiting, Alfred E.

1939 *Ethnobotany of the Hopi*. Museum of Northern Arizona Bulletin no. 15, Museum of Northern Arizona, Flagstaff.

1940 *New Material from Acoma*. Anthropological Papers No. 32. Bureau of American Ethnology Bulletin 136. Smithsonian Institution, Washington D.C.

Wiessner, Polly and Wulf Schiefenhövel (editors)

1996 *Food and the Status Quest: An Interdisciplinary Perspective*. Berghahn Books, Oxford.

Wilk, Richard

2006 *Home Cooking in the Global Village : Caribbean Food from Buccaneers to Ecotourists*. Berg, New York.

Wills, W.H.

2001 Pithouse Architecture and the Economics of Household Formation in the Prehistoric American Southwest. *Human Ecology* 29:477–500.

Wills, W.H. and Patricia L. Crown

2004 Commensal Politics in the Prehispanic Southwest: An Introductory Review. In *Identity, Feasting, and the Archaeology of the Greater Southwest*, edited by Barbara J. Mills, pp. 153–172. University Press of Colorado, Boulder.

Wing, E. and A. Brown

1979 *Paleonutrition: Method and Theory in Prehistoric Foodways*. Academic Press, New York.

Wolfe, Eric R.

1982 *Europe and the People without History*. University of California Press, Berkeley.

Wollstonecroft, Michèle M.

2011 Investigating the role of food processing in human evolution: a niche construction approach. *Archaeological and Anthropological Sciences* 3:141-150.

Yang, Dongya Y. Joshua R. Woiderski, and Jonathan C. Driver

2005 DNA analysis of archaeological rabbit remains from the American Southwest. *Journal of Archaeological Science* 32:567–578.

Yarnell, Richard A.

1965 Implications of Distinctive Flora on Pueblo Ruins. *American Anthropologist* 67:662-674.

Zack-Horner, Jennifer

1999 Aggregation and the Silver Creek Faunal Record. In *Living on the Edge of the Rim*, edited by B.J. Mills, S.A. Herr, S. Van Keuren, pp. 433–458. Archaeological Series, 192. Arizona State Museum, Tucson.

Zier, Christian J.

1976 *Excavations near Zuni, New Mexico: 1973*. Museum of Northern Arizona Research Paper 2, Museum of Northern Arizona, Flagstaff.

1983 Processes of Growth and Development in a Thirteenth Century A.D. Pueblo as Reflective of Demographic and Climatic Changes in the Zuni, New Mexico Area. *Journal of Intermountain Archaeology* 11:28–45.

Zlotin, R. I. and R.R. Parmenter

2008 Patterns of mast production in pinyon and juniper woodlands along a precipitation gradient in central New Mexico (Sevilleta National Wildlife Refuge). *Journal of Arid Environments* 72:1562-1572.

Zuni People
1972 *The Zunis Self-Portrayals*. Translated by Alvina Quam. University of New Mexico Press, Albuquerque.

Zunie, Jerome
2004 Analysis of Faunal Remains. In *To Command and Carry the Waters: An Archaeological Inventory and Analysis of the Excavations at* K'Yawa:Na'A Deyatchinanne *(NM:12:K3:392) Zuni, New Mexico*, edited by Jonathan Damp and Jeffery Waseta, pp. 213–220. Zuni Cultural Resource Enterprise Report, 670. Zuni Cultural Resource Enterprise, Zuni.

APPENDIX A

ZUNI NAMES FOR PREHISPANIC PLANT AND ANIMAL FOODS

Table A.1. Scientific and Common English and Zuni Names for Plant and Animal Foods

	Scientific Name	Common Name (English)	Common Name (Zuni)	Reference(s)
Plant Foods	*Achnatherum hymenoides*	ricegrass	*kôw'dĕlthi*	Stevenson 1915:67
	Amaranthus sp.	pigweed	*k'ushutsi*	Stevenson 1915:65
	Artemesia sp.	sagebrush	*a:ku*	E.Tsalate pers. comm. August 23, 2018
	Astragalus sp.	milkvetch	*ha'onawe*	Stevenson 1915:65
	Atriplex sp.	saltbush	*sułdo'kya*	E.Tsalate pers. comm. August 23, 2018
	Chenopodium sp.	goosefoot	*suthl'-to-k'-ia*	Cushing 1999:244
	Cleome sp.	beeweed	*ado:we*	Edaakie 1999:31
	Cucurbita sp.	squash	*me:mo'le*	Edaakie 1999:19; Bohrer 1960:197
	Cucurbita pepo	pumpkin	*mo:deyaiła*	E.Tsalate pers. comm. August 23, 2018
	Descurainia sp.	tansy Mustard	*ayaho*	E.Tsalate pers. comm. August 23, 2018
	Echinocerus sp.	hedgehog cactus	*k'o:shi*	E.Tsalate pers. comm. August 23, 2018
	Gossypium hirsutum	cotton	*bittsemi*	E.Tsalate pers. comm. August 23, 2018
	Helianthus sp.	sunflower	*oma:ts'a:ba*	E.Tsalate pers. comm. August 23, 2018
	Juniperus sp.	juniper	*homaya: datdanne*	E.Tsalate pers. comm. August 23, 2018
	Phaseolus sp.	bean	*no'we*	Stevenson 1915:69-70
	Physalis sp.	tomatillo	*k'e:ts'ido'kya*	Edaakie 1999:83
	Solanum sp.	wild potato	*k'yabi mo'le*	E.Tsalate pers. comm. August 23, 2018
	Pinus sp.	pinyon	*he'sho k'ukwe*	E.Tsalate pers. comm. August 23, 2018
	Platyopuntia	prickly pear	*duya:we*	Edaakie 1999:23; Stevenson 1915:69
	Portulaca sp.	purslane	*midalik'o*	Edaakie 1999:19
	Quercus sp.	oak acorns	*da'wi* *da'wi k'uwe*	E.Tsalate pers. comm. August 23, 2018
	Rhus trilobata	Sumac	*k'osse*	E.Tsalate pers. comm. August 23, 2018
	Salvia sp.	chia, mint	*mattsa*	E.Tsalate pers. comm. August 23, 2018
	Typha sp.	cattail	*owelu*	E.Tsalate pers. comm. August 23, 2018
	Xanthium sp.	cockleburr	*be:motchikyaba*	Stevenson 1915:71
	Yucca baccata	banana yucca	*ho'kyaba'hotdonne ts'ubiyanne*	Stevenson 1915:72; Edaakie 1999:21
	Yucca glauca	soapweed yucca	*ho:ts'ana' hotdonne*	Cushing 1920:231; Stevenson 1915:73
	Zea Mays	maize ears of maize kernels religious or cultural reference	*shetdanne* *miwe* *chuwe* *a:dowa*	Edaakie 1999:26; Stevenson 1915:73; E.Tsalate pers. comm. August 23, 2018

Table A.1. Continued

	Scientific Name	Common Name (English)	Common Name (Zuni)	Reference(s)
Animal Foods	*Antilocapra americana*	pronghorn	*ma'wi*	E.Tsalate pers. comm. August 23, 2018
	Bison bison	bison	*si:wolo*	E.Tsalate pers. comm. August 23, 2018
	Colaptes sp.	flicker (red/yellow)	*hokwisho*	E.Tsalate pers. comm. August 23, 2018
		flicker (black)	*hokwisho k'winna*	E.Tsalate pers. comm. August 23, 2018
	Cynomys sp.	prairie dog	*k'ushi*	E.Tsalate pers. comm. August 23, 2018
	Lepus sp.	jackrabbit	*bok'ya*	E.Tsalate pers. comm. August 23, 2018
	Meleagris gallopavo	turkey	*dona*	Edaakie 1999:62
	Neotoma sp.	woodrat	*k'ochi*	E.Tsalate pers. comm. August 23, 2018
	Odocoileus sp.	deer	*nawe*	E.Tsalate pers. comm. August 23, 2018
	Odocoileus virginianus	whitetail deer	*shoh'kwida* or *shoh'hida*	E.Tsalate pers. comm. August 23, 2018
	Odocoileus hemionus	mule deer	*ohho'li*	E.Tsalate pers. comm. August 23, 2018
	Orthoptera	grasshopper	chapba	E.Tsalate pers. comm. August 23, 2018
	Osteichthyes	fish	*k'yashshida*	E.Tsalate pers. comm. August 23, 2018
	Ovis canadensis	bighorn sheep	*haluk'o* or *halik'o*	E.Tsalate pers. comm. August 23, 2018
	Sciurus sp.	squirrel	*yashi*	E.Tsalate pers. comm. August 23, 2018
	Spermophilus sp	rock squirrel	*ohchi*	E.Tsalate pers. comm. August 23, 2018
	Sylvilagus sp.	cottontail	*ok'shik'o*	E.Tsalate pers. comm. August 23, 2018
	Zenaida macroura	dove	*ni:shobak'o*	E.Tsalate pers. comm. August 23, 2018

APPENDIX B

CIBOLA PLANT DATA

Table B.1. Cibola Plant Database Sites and Analyzed Macrobotanical and Pollen Samples

	Region	Period	Site Name	Site Number	No. Flotation	No. Pollen	References
Core Study Areas	CEN	PII	LA 129241	LA 129241	22	40	Damp and Waseta 2004
	CEN	PII	NM:12:K3:4	NM:12:K3:4	20	11	Varien 1987
	CEN	PII	NM:12:K3:101	NM:12:K3:101	37	26	Howell 2000
	CEN	PII	NM:12:K3:102	NM:12:K3:102	45	50	Howell 2000
	CEN	PII	NM K3:252	NM:12:K3:252	11	2	Varien 1990
	CEN	PIII	NM:12:K3:108	NM:12:K3:108	6	4	Howell 2000
	CEN	PIII	Hinkson	LA 11439	29	7	Adams 2007; OBAP notes; Schoenwetter 1992
	CEN	PIII	NA 11527, 11530	NA 11527, 11530	12		Zier 1976, Miksicek n.d.
	CEN	PIV	Halon:wa North	LA 9093	7	24	Rude and Adams 2006; Smith 2003
	CEN	PIV	Heshot uła	LA 2114	27		HARP notes
	CEN	PIV	Lower Pescado Village	NM:12:13:109	16	5	Rothschilde and Dublin 1995
	EMV	PIII	LA 132353	LA 132353	11	13	Howell 2004
	EMV	PIII	Los Gigantes	LA 56159	19		Adams 2007; EMVPP notes
	EMV	PIII	Scribe S	LA 59321-56	44		Watson et al. 1980, Miksicek n.d.
	EMV	PIII	Tinaja	NM:12:G3:99	17		Watson et al. 1980, Miksicek n.d.
	EMV	PIII	Vogt Ranch	NM:12:H3:56	41		Brandt 1992
	EMV	PIV	Atsinna	NM:12:G3:121	22		Watson et al. 1980, Miksicek n.d.
	EMV	PIV	North Atsinna	LA 430	1		Watson et al. 1980, Miksicek n.d.
	EMV	PIV	Cienega	NM:12:G3:96	40		Watson et al. 1980, Miksicek n.d.
	EMV	PIV	Hokona	LA 153714	36	9	Raily 2008
	EMV	PIV	Mirabal	NM:12:G3:97	23		Watson et al. 1980, Miksicek n.d.
	EMV	PIV	Pueblo de los Muertos	NM:12:G3:20	26		Watson et al. 1980, Miksicek n.d.
	ULC	PII	NA 14,648	NA 14,648	14	4	Gasser 1982
	ULC	PII	NA 14,649	NA 14,649	13	11	Gasser 1982
	ULC	PII	NA 14,651	NA 14,651	13	8	Gasser 1982
	ULC	PII	NA 14,654	NA 14,654	36	11	Gasser 1982
	ULC	PII	AZ Q:12:7,9-11,16,18	AZ Q:12:7,9-11,16,18	42	64	Doyel and Debowski 1980
	ULC	PII	LA 87070, 105990, 86249, 87059	LA 87070, 105990, 86249, 87059	20	6	Huber and Van West 2005
	ULC	PII	AZ Q:8:38; AZ Q:8:61	AZ Q:8:38; AZ Q:8:61	10		Gilpin 2004
	ULC	PII	Platt Ranch	AZ Q:7:26; AZ Q:7:27	8	5	Westfall 1981
	ULC	PIII	NA 14,650	NA 14,650	67	28	Gasser 1982
	ULC	PIII	Rudd Creek	AZ Q:16:63	10		Oas 2017c; RCAP notes
	ULC	PIV	Baca Pueblo	AZ Q:11:74	10		Oas 2017c; ULCPP notes
	ULC	PIV	Casa Malpais	AZ Q:15:3 ASM	10		Brandt 1994a
	ULC	PIV	Rattlesnake Point Pueblo	AZ:Q:11:118	10		Oas 2017c; ULCPP notes

Table B.1. Continued

	Region	Period	Site Name	Site Number	No. Flotation	No. Pollen	References
Complementary Study Areas	Puerco West	PII	Jones Ranch Road	NM 12:U2:6-7, 62-63, 98, 108A-B	118	75	Anyon et al. 1983
	Puerco West	PII	Sanders Great House	AZ K:15:16	214	58	Fletcher 1994
	Puerco West	PII	Sanders Site	AZ K:15:17; AZ K:15:27	15	4	Fletcher 1994
	Puerco West	PIII	Sanders Site	AZ K:15:28	23	3	Fletcher 1994
	Puerco West	PIV	Puerco Ruin	AZ Q:1:22	20	9	Burton 1990
	Silver Creek/ AZ Mountains	PII	AZ P:16:5	AZ P:16:5	13		Stafford and Rice 1980
	Silver Creek/ AZ Mountains	PII	Cothrun's Kiva	AZ P:12:277	7		Mills et al. 1999
	Silver Creek/ AZ Mountains	PII	GBU	AZ P:16:12	52	10	Stafford and Rice 1980
	Silver Creek/ AZ Mountains	PII	Hough's Great Kiva	AZ P:16:112	14		Mills et al. 1999
	Silver Creek/ AZ Mountains	PII	Fool's Hollow Ridge	NA 18,343	21	19	Dosh 1988
	Silver Creek/ AZ Mountains	PII	Right Hand Ridge	NA 18,346	18	13	Dosh 1988
	Silver Creek/ AZ Mountains	PII	Wild Turkey Site	AZ Q 13:9	28	8	Stafford and Rice 1980
	Silver Creek/ AZ Mountains	PIII	Broken K	L.S. 156	ND	ND	Hill 1970
	Silver Creek/ AZ Mountains	PIII	Pine Ridge Ruin	NA 19,331	13	7	Dosh 1988
	Silver Creek/ AZ Mountains	PIII	Pottery Hill	AZ P:12:12	24		Mills et al. 1999
	Silver Creek/ AZ Mountains	PIII	Chodistaas	AZ P:14:24	27		Welch 1996
	Silver Creek/ AZ Mountains	PIV	Bailey Ruin	AZ P:11:1	36		Mills et al. 1999
	Silver Creek/ AZ Mountains	PIV	Grasshopper	AZ P:14:1	ND	ND	Longacre et al. 1982; Welch 1996
	Silver Creek/ AZ Mountains	PIV	Point of Pines	W:10:50	ND	ND	Bohrer 1973

Table B.2. Cibola Cob Row-Numbers

	Region	Period	Site Name	Cob (n=)	Mean Row No.	8 row	10 row	12 row	14 row	16 row	Reference
Core Study Areas	CEN	PII	Oak Wash	34	8.8	22	11	1	0	0	Howell 2000
		PIII	Oak Wash	37	9.2	16	20	1	0	0	Howell 2000
		PIII	NA 11,527	237	10.5	34	115	78	10	0	Collected by author
		PIII	Nutria	253	10.5	56	117	63	17	0	Miksicek n.d.
		PIV	Heshot uła	7	8.5	5	2	0	0	0	Collected by author
	EMV	PIII	Pettit	15	9.6	8	2	5	0	0	Collected by author
		PIII	Los Gigantes	7	9.7	3	3	0	1	0	Collected by author
		PIII	Scribe S	2550	9.8	963	996	517	65	9	Miksicek n.d.
		PIII	Tinaja	184	10.1	53	81	40	9	1	Miksicek n.d.
		PIV	Pueblo de los Muertos	76	9.2	41	22	10	3	0	Miksicek n.d.
		PIV	Atsinna	71	9.4	31	32	8	0	0	Miksicek n.d.
		PIV	Cienega	100	9.5	44	36	20	0	0	Miksicek n.d.
		PIV	Mirabal	33	9.5	17	9	5	2	0	Miksicek n.d.
		PIV	Hokona	26	9.6	9	13	4	0	0	Raily 2008
	ULC	PIII	Rim Valley	2	10	0	2	0	0	0	Collected by author
		PIV	Hooper Ranch	45	10.6	5	22	17	1	0	Collected by author
		PIV	Table Rock	49	9.6	19	22	7	0	1	Collected by author
		PIV	Casa Malpais	503	9	277	204	21	1	0	Collected by author
		PIV	Baca	3	8.7	2	1	0	0	0	Collected by author
		PIV	Rattlesnake	471	9.1	232	220	16	3	0	Collected by author
Other	Hay Hollow Valley	PII	Carter Ranch	354	10.4	82	139	119	12	2	Martin et al. 1964
	Silver Creek	PIII	Pottery Hill	8	8.5	6	2	0	0	0	Mills et al. 1999
		PIV	Bailey Ruin	4	9.2	1	2	1	0	0	Mills et al. 1999

APPENDIX C

CIBOLA FAUNA DATA

Table C.1. Cibola Site NISP and Artiodactyl, Turkey, and Lagomorph Indices

	Region	Period	Site Name	Site Number	NISP	AI	TI	LI	No. of Articulated Turkeys	References
Core Study Areas	CEN	PII	LA 129241	LA 129241	1112	0.1	1	0.62	0	Damp and Waseta 2004
	CEN	PII	NM:12:K3:101	NM:12:K3:101	902	0	0.8	0.64	1	Stratton et al. 2000
	CEN	PII	NM:12:K3:102	NM:12:K3:102	1837	0	0.3	0.65	0	Stratton et al. 2000
	CEN	PII	NM:12:K3:213	NM:12:K3:213	2108	0	0	0.55	0	Stratton et al. 2000
	CEN	PII	H-Spear	LZ1087	394	0	0	0.3	0	OBAP 1998
	CEN	PIII	Hinkson	LA 11439	6202	0	0.1	0.52	3	OBAP 1998
	CEN	PIII	Jaralosa	LA 3993	120	0	0	0.33	0	OBAP 1998
	CEN	PIII	NA 11527	NA 11527	248	0.2	0.5	0.85	0	Museum of Northern Arizona notes
	CEN	PIV	NA 11530	NA 11530	1059	0.1	0.5	0.72	2	Museum of Northern Arizona notes
	CEN	PIV	Heshot uła	LA 2114	1807	0.1	0.2	0.83	0	Thiel 1996
	CEN	PIV	Lower Pescado Village	NM:12:13:109	337	0.1	0.3	0.88	0	Rothschilde and Dublin 1995
	CEN	PIV	Ojo Bonito	NM:M:1:3	197	0	0.1	0.75	0	OBAP 1998
	EMV	PIII	LA 132353	LA 132353	46	NA	NA	NA	0	Howell 2004
	EMV	PIII	Los Gigantes	LA 56159	524	0.5	0.6	0.65	0	Clark 2006
	EMV	PIII	Pettit	LA 1571	ND	ND	ND	ND	1	University of Denver Museum of Anthropology notes
	EMV	PIII	Scribe S	LA 59321-56	1363	0.4	0.5	0.83	0	Clark 2007
	EMV	PIII	Tinaja	NM:12:G3:99	855	0.2	0.2	0.62	0	Clark 2007
	EMV	PIV	Atsinna	NM:12:G3:121	921	0.3	0.4	0.91	0	Clark 2007
	EMV	PIV	Cienega	NM:12:G3:96	3294	0.3	0.5	0.86	0	Clark 2007
	EMV	PIV	Mirabal	NM:12:G3:97	5006	0.1	0.4	0.75	1	Clark 2007
	EMV	PIV	Pueblo de los Muertos	NM:12:G3:20	13651	0.4	0.5	0.8	0	Clark 2007
	ULC	PIII	Rudd Creek	AZ Q:16:63	1078	0.4	0.1	0.91	0	Clark 1998b
	ULC	PIV	Baca Pueblo	AZ Q:11:74	2223	0.1	0	0.61	0	Clark 2008
	ULC	PIV	Rattlesnake Point Pueblo	AZ:Q:11:118	32586	0.3	0.1	0.63	1	Clark 2008

Table C.1. Continued

	Region	Period	Site Name	Site Number	NISP	AI	TI	LI	No. of Articulated Turkeys	References
Complementary Study Areas	Puerco West	PII	Sanders Great House	AZ K:15:16	3326	0.1	0.2	0.43	0	Lippmeier 1994
	Puerco West	PII	Sanders Site	AZ K:15:17	141	0.3	0.1	0.33	0	Lippmeier 1994
	Puerco West	PIV	Puerco Ruin	AZ Q:1:22	1951	0	0	0.75	0	Gillespie 1990
	Silver Creek/ AZ Mountains	PII	Cothrun's Kiva	AZ P:12:277	455	0	0	0.39	0	Zack-Horner 1999
	Silver Creek/ AZ Mountains	PII	Hough's Great Kiva	AZ P:16:112	189	0.1	0.6	0.14	0	Zack-Horner 1999
	Silver Creek/ AZ Mountains	PIII	Pottery Hill	AZ P:12:12	1374	0.1	0	0.48	0	Zack-Horner 1999
	Silver Creek/ AZ Mountains	PIV	Bailey Ruin	AZ P:11:1	3176	0.6	0.2	0.37	0	Zack-Horner 1999
	Silver Creek/ AZ Mountains	PIV	Grasshopper	AZ P:14:1	45736	0.6	0.1	0.8	5	Olsen 1990
	Mariana Mesa	PII	Cox Ranch	LA 13681	11445	0	0	0.48	1	Mueller 2006
	Mariana Mesa	PII	Largo Gap	LA 3918	9637	0.1	0	0.73	1	Boughknight 2014
	Mariana Mesa	PIII	AS-6	LA 12133	445	0.1	0.2	0.61	0	Bice 2006
	Mariana Mesa	PIII	Techado Springs	La 2148	718	0.6	0.2	0.56	0	Tawater 2009

APPENDIX D

CIBOLA METATE AND MANO DATA

Electronic versions of the raw Cibola groundstone mano and metate data files used in this dissertation are available through the Digital Archaeological Record (tDAR) data repository http://www.tdar.org.

D.1. Permanent link to raw metate data associated with this dissertation:
Metate data - Chapter 6. Sarah Oas. 2019 (tDAR id: 448117)
doi:10.6067/XCV8448117

D.2. Permanent link to raw mano data associated with this dissertation:
Mano data - Chapter 6. Sarah Oas. 2019 (tDAR id: 448118)
doi:10.6067/XCV8448118

D.3. Permanent link to complete mano measurement data associated with this dissertation:
Mano measurement data - Chapter 6. Sarah Oas. 2019 (tDAR id: 448119)
doi:10.6067/XCV8448119

APPENDIX E

CIBOLA CERAMIC VESSEL DATA

Electronic versions of the raw Cibola ceramic vessel data files used in this dissertation are available through the Digital Archaeological Record (tDAR) data repository http://www.tdar.org.

E.1. Permanent link to raw corrugated jar data associated with ceramic vessel data from this dissertation:
Corrugated ceramic jar data - Chapter 7. Sarah Oas. 2019 (tDAR id: 448121)
doi:10.6067/XCV8448121

E.2. Permanent link to raw decorated jar data associated with ceramic vessel data from this dissertation:
Decorated ceramic jar data - Chapter 6. Sarah Oas. 2019 (tDAR id: 448122)
doi:10.6067/XCV8448122

E.3. Permanent link to raw bowl data associated with ceramic vessel data from this dissertation:
Ceramic bowl data - Chapter 8. Sarah Oas. 2019 (tDAR id: 448123)
doi:10.6067/XCV8448123

E.4. Permanent link to raw ladle data associated with ceramic vessel data from this dissertation:
Ceramic ladle data. Sarah Oas. 2019 (tDAR id: 448124)
doi:10.6067/XCV8448124

APPENDIX F

CIBOLA THERMAL FEATURE DATA

Electronic versions of the raw Cibola thermal feature data files used in this dissertation are available through the Digital Archaeological Record (tDAR) data repository http://www.tdar.org.

F.1. Permanent link to raw data associated with thermal feature data from this dissertation:
Thermal feature data - Chapter 7. Sarah Oas. 2019 (tDAR id: 448125) doi:10.6067/XCV8448125

APPENDIX G

ETHNOGRAPHIC RECORDS OF PLANT INGREDIENTS, PREPARATION AND COOKING TECHNIQUES AT ZUNI PUEBLO

G.1. Ethnographic Records of Plant Ingredients, Preparation Steps, and Cooking Techniques at Zuni Pueblo

Plant/Animal Taxon	Common Name	Plant Part	Other Ingredients	Preparation Activities	Cooking Technique	Reference
Achnatherum sp.	ricegrass	seeds	water	ground, mixed into balls	steamed in pot	Stevenson 1915:67
Amaranthus sp.	amaranth	seeds	corn meal, water	ground, mixed into balls	steamed in pot	Stevenson 1915:65
Artemesia sp.	sagebrush	seeds	water	ground, mixed into balls	steamed in pot	Stevenson 1915:65
Asclepias sp.	milkweed	buds		consumed raw		Stevenson 1915:65
Astragalus sp.	milkvetch	pods		dried		Stevenson 1915:65-66
		pods	water, salt		boiled	
		pods	mashed onion, brine sauce		toasted in ashes	Cushing 1920:227
Atriplex sp.	sagebrush	seeds	corn meal, water	ground	cooked into mush	Stevenson 1915:66
Cleome sp.	beeweed	leaves	corn, chile	dried	boiled	Stevenson 1915:69
Cucurbita pepo	pumpkin	flesh			boiled, roasted in ashes	Stevenson 1915:67
		flesh		cut	boiled	Cushing 1920:561
		flesh			baked	Cushing 1920:561
		flesh		cut	fried	Cushing 1920:561
		blossoms	grease		fried	Stevenson 1915:67
Cucurbita moschata	winter squash	flesh	green corn, sunflower seeds	ground together	boiled into thick soup	Cushing 1920:265
Cucurbita sp.	squash	flesh	grease		fried on slabs	Cushing 1920:228
Cycloloma atriplicifolium	winged pigweed	seeds	corn meal, water	ground, formed into balls	steamed in pot	Stevenson 1915:67
Euphorbia	spurge	root	corn meal	mixed in mouth to create sweetener		Stevenson 1915:67-68
		leaves		chewed		
Juniperus sp.	juniper	fruit		dried, ground	boiled, roasted	Cushing 1920: 243
Lycium sp.	wolfberry	berries	water		boiled	Stevenson 1915:68
		berries			stewed	Cushing 1920: 242
Lycoperdon	puffball	mushroom		consumed raw		Stevenson 1915:69
		mushroom	mashed onion, brine sauce, Apiaceae seeds	peeled	toasted	Cushing 1920:228
		mushroom		dried		Stevenson 1915:69
Cylindropuntia sp.	cholla	fruit		despined, dried, ground	toasted	Cushing 1920: 237-238
Opuntia sp.	prickly pear	fruit		spines rubbed off	stewed	Stevenson 1915:69
		fruit	parched corn meal	dried and ground	cooked into mush	Stevenson 1915:69

G.1. Continued

Plant/Animal Taxon	Common Name	Part	Other Ingredients	Preparation Activities	Cooking Technique	Reference
Phaseolus sp.	bean	cotyledon	grease		boiled, fried	Stevenson 1915:69-70
		cotyledon	mush	crushed	boiled	Stevenson 1915:69-70
		cotyledon		wrapped in corn husks	baked	Stevenson 1915:69-70
		cotyledon		mashed	boiled, baked in ashes	Cushing 1920:561
		cotyledon	salt		parched	Bohrer 1960:190
		cotyledon	meat		stewed	Stevenson 1915:69-70
Physalis sp.	tomatillo	fruit	water	crushed	boiled	Stevenson 1915:70
		fruit	raw onion, chile, coriander seed	ground	boiled	Stevenson 1915:70
Pinus sp.	pinyon	nut			toasted	Stevenson 1915:70
Ribes sp.	currant	leaves	sheep or deer fat			Stevenson 1915:70
		fruit		consumed raw		Stevenson 1915:70
Solanum sp.	wild potato	fruit	goat's milk	curdled with berries as beverage		Stevenson 1915:70
		tuber				Stevenson 1915:71
		tuber	wild onion	skinned, detoxified with white clay or ashes	boiled, stewed	Cushing 1920: 227
		fruit	chile, salt		boiled	Stevenson 1915:71
Triticum sp.	wheat	seeds	starter	ground, shaped	baked	Stevenson 1915:71
		seeds		ground	baked	Stevenson 1915:71
		seeds	wheat flour	sprouted, ground, mixed	baked	Stevenson 1915:71
		seeds	grease	ground	fried	Stevenson 1915:71
Yucca baccata	banana yucca	fruit		pared	boiled	Stevenson 1915:72
		fruit		peeled, chewed, deseeded, dried	boiled	Stevenson 1915:72-73
		fruit		peeled, chewed, deseeded, fermented, dried	boiled	Cushing 1920: 233-235
		fruit	(water with or without ashes), brine sauce	cleaned after boiling	boiled	Cushing 1920: 230
Y. glauca	soapweed yucca	fruit			boiled	Stevenson 1915:73
		fruit			roasted in ashes	Cushing 1920: 229-234
		fruit			boiled	Cushing 1920: 229-231
Zea mays[1]	maize	kernels	water, wood ash	kernels removed, washed	boiled, stewed	Stevenson 1915:76
		cobs		dried, husks pulled back	roasted in earthen pits	
		kernels	salt		popped	

[1] The list of preparation and cooking techniques for maize presented here is not comprehensive. See Table G.2. for an extensive list of maize breadstuff recipes.

G.2. Ethnographic Records and Recipes of Maize Breadstuffs at Zuni Pueblo

Cooking Technique	Zuni Name	Recipe	Reference
Steamed	*Adeya:mu'le*	Cake made of dried sprouted (masticated) pumpkin blossoms mixed with white corn meal and steamed in maize husks	Allen 1995:30; Edaakie:1999: 45
	Chuts'iya:muwe	Blue corn tamales	Edaakie 1999:54
	K'ia-mu-k'iä-li-we	Stewed dumplings made of finely ground maize flour boiled in water into a paste. Additional meal is added to the paste to make a stiff dough that is formed into little balls. The dough balls are spread over a yucca sieve or screen of sticks and placed in a small pot partially filled with water that is nested inside a larger pot half-filled with water. The larger pot is placed over the fire and covered to allow the dough balls inside to steam.	Cushing 1920: 299-300
Baked on coals or in ashes	*Mui'-ä-ti-we*	Fine maize flour is mixed with cold water in a bowl to make a dough, lime-yeast is added to leaven it. This dough is then kneaded and formed into thick cakes, which are set away a short time to rise, and then cooked on hot coals by frequent turning	Cushing 1920: 303
	Lu-pan-mu'-lo-ka-na	Fine maize flour is mixed with cold water and leavened with lime-yeast. The dough is baked by burying it deep under hot ashes.	Cushing 1920: 303
	N.D.	Coarse maize meal is mixed with boiling water to form a sticky dough and rolled into balls. The balls are flattened and left to dry or baked on hot embers.	Cushing 1920:254
	N.D.	Acorns, pinyon nuts, chenopodium, and/or sunflower seeds are parched and ground and (1) added to stews (2) parched again and added as shortening in other recipes, or (3) taken as is and baked in ashes or wrapped in leaves and baked	Cushing 1920: 252-253
Parched or Toasted	*Alekwi:we*	Maize kernels (and sometimes pinyon nuts) parched in hot sand in a pot and sprinkled with salt	Allen 1995:35; Edaakie 1999:73
		Dried kernels are parched (1) directly in hot ashes or (2) in a pot filled with sand heated over the fire. Kernels are constantly stirred with a bundle of loosely strung twigs.	Cushing 1920:165-166, 267
	He'-la-kwi-we	Dried leftover flakes of *he-we* are toasted and crumbled by hand, combined with salt and fat and put into a jar they can be toasted and further ground into a meal consumed on journeys	Cushing 1920: 339-340
Boiled in Pots or Baskets	*Ä'-tea-mu-we*	Yellow cornmeal batter sweetened through mastication and fermentation (or the addition of dried flowers) is shaped into crescents and boiled wrapped in corn husks.	Cushing 1920:300-301, 557
	Chummali	Soaked, fried, or parched locusts mixed with cornmeal and cooked into mush	Cushing 1920: 562; Edaakie 1999:69
	Chuwe Sumapbonne	Stew or mush made with white corn	Edaakie 1999: 50
	Mi'-li-a-we	Baked corn boiled on the ear	Cushing 1920: 291
	Muk'yaba:we	Coarse-to medium-fine corn meal is mixed with boiling water to form a stiff dough with slaked lime added for color. Cold water is then added to create a batter that is shaped into large oval balls. These are boiled in cooking pots and eaten cold.	Allen 1995:26; Stevenson 1904:363, 1915:74
	Chut'siya:we	An alternative version of *muk'yaba:we*, where dumplings are made with blue corn skinned by soaking in water with ashes. Once rinsed the wet corn is ground, kneaded into stiff dough, mixed with lime, and wrapped tightly in corn husks and boiled.	Allen 1995:26; Cushing 1920: 297-298
	Mukk'yali:we	Finely ground meal of roasted or toasted maize is mixed with cold water, lime, and salt. The mush is kneaded to form a batter, rolled into strings, and broken to form small balls around an inch in diameter. These are dropped into a pot with just enough boiling water to cook them. Once the balls hardened into mushy dumplings, the mixture is poured into a large bowl, seasoned with a brine sauce, and eaten with a ladle. The remaining liquid (*k'yasli:we*) is also consumed.	Allen 1995:26; Cushing 1920: 297-298; Stevenson 1904:363, 1915:74

G.2. Continued

Cooking Technique	Zuni Name	Recipe	Reference
Boiled in Pots or Baskets (cont.)	*Tsa'shi-we*	Maize kernels are coarsely ground, toasted, and then ground into fine flour. This flour can be stirred into cold water to make a gruel and consumed without further cooking and eaten on extended journeys. Other preparations involved fermenting and sweetening the mixture with various ground flowers and roots and boiled to make a popular sweet gruel.	Cushing 1920:265-266
	Tchu'-li-a-we	An ear of maize is roasted or browned over the coals, then shelled and boiled in water, either with or without meat. A more elaborate form is called "skinned corn," where kernels are excessively boiled in wood-ashes and water to remove the pericarp (outer skin), then thoroughly washed and again boiled, either consumed directly or used as the base for other breads, dumplings, or griddle-cakes	Cushing 1920:291-293
	Tchu'-k'i-na	Sweet corn, or white or yellow corn, is boiled with cob-ashes until the pericarp can be removed. After drying a day or two the corn is toasted in a pot, ground into a coarse meal, toasted again, ground to very fine flour, once more toasted, and then carefully sifted. It takes a bushel of corn to make a few quarts of this flour. A single teaspoonful of this power when stirred into a pint of water, made a thick batter which can be drunk and a few sips are filling. It can also be combined with dried ground meat mixed with red pepper and salt	Cushing 1920:341-342
	Tchu'-tsi-kwah-na-mu'-we	Dumplings made with "skinned" kernels (pericarp removed) which are ground with water to form a fine, sticky batter. This is seasoned with lime-yeast and wrapped in corn husks and boiled. Great quantities of these rubbery dumplings were made at a time, as the process of their manufacture was tedious and laborious. When cold they were freshened by roasting on the embers or by baking in the little hearth-cists of the kitchen	Cushing 1920: 301
	N.D.	Coarsely-ground maize meal is mixed with hot water to make a sticky dough and thoroughly kneaded and rolled into little cylinders of dough. These cylinders are wrapped in husks and placed into a basket filled with hot stones to cook. The stones are removed and the remaining fluid, now thick, like gruel or gravy, is allowed to settle, poured off and served with lumps of mush or dumplings. Little slices or fragments of jerked meat are sometimes cooked within the dumplings. A meal of juniper berries was kneaded into the dough to sweeten it and produce an aromatic flavor. Juniper twigs can also be thrown into the boiling water.	Cushing 1920:254-255
	N.D.	Seeds of amaranth, ricegrass, or other grasses are ground into a meal and boiled to make mushes or used to make other breads and cakes	Cushing 1920:253-254
Roasted and/or Baked in Pits	*Hebalo:we*	A bread pudding made of a batter of sweetened corn meal mixed with boiling water and cooking in large pots and/or husks set deep in a bed of hot embers in a specially made outdoor pit or oven, covered, and left to bake overnight	Allen 1995:34; Stevenson 1904: 366
	K'os-he-pa-lo-kia	"Salty buried-bread" is made with coarse, white-corn meal mixed with water, fine white-corn flour, and salt to create a very sticky batter. Corn husks soaked in hot water are then laid on a flat stone and the batter is spread over them to the thickness of about an inch, covered with more husks folded at the edges to keep the batter in place, covered over with another stone, and so on. This bread is baked in heated hearths which are sealed up with mud and baked by a night-long fire	Cushing 1920: 304-305
	Tchik-k'we; pa-lo-kia	Batter made of meal sweetened through mastication and fermentation or with the addition of dried flowers or wild honey. This batter is baked slowly in pits in small ceramic jars well lined with husks to keep the batter from adhering to its sides.	Stevenson 1904: 366
	N.D.	Ears of green corn roasted on coals or boiled in little narrow-necked pots	Cushing 1920:264
	N.D.	"Stone-cakes" made with a sweetened corn batter baked in huge sandwiches composed of alternating layers of hot sandstone slabs and batter that were carefully enclosed in a casing of larger slabs cemented with mud, and buried in a hot pit over which a fire was built	Cushing 1920:255-256

G.2. Continued

Cooking Technique	Zuni Name	Recipe	Reference
Oven-Baked	*Chu:lupts'inna Mu'le Chikwa*	Yellow cornmeal sweet bread	Edaakie 1999:3, 10
	He'Balokya	A bread pudding made of a batter of sweetened corn meal mixed with boiling water, wrapped in corn husks and cooked in an oven	Allen 1995:34
		Yellow or black corn is ground twice and sifted. Some meal is placed in a large bowl and mixed with boiling water, to which is added a cupful of meal sweetened by mouth. Slabs are heated in the *he-we* cooking hearth. Corn husks are laid flat and covered with batter. More husks are used to cover the batter. Sheets of batter and slabs are then laid down and covered with a final slab. A fire is built above and it bakes overnight in this makeshift oven	Stevenson 1915:75
	Mu'loowe	Dough is soaked to soften it; additional flour is mixed in and the dough is covered overnight to rise. The following day warm water is added to the sponge and kneaded, salt and flour are added while kneading continues	Stevenson 1904:364
	N.D.	This bread is made from a mush mixed with sour dough or sweetened batter to make it rise. It is kneaded into small, thick lumps which are placed into a heated oven. The oven opening is closed with a sandstone slab, every crevice perfectly cemented with mud, and left to bake for a day	Cushing 1920:256-257
Fried on Griddle	*Hebatchi:we*	(wheat dough) tortillas baked on polished stone slabs supported over the fireplace	Stevenson 1904:363, 1915: 71
		(corn dough) tortillas made by pouring diluted lye over corn, which is soaked until the hulls are shed, and then the corn is washed, dried, and ground. The meal is mixed with water and made into cakes which are baked on a well-greased small circular sandstone slabs 8-10 inches in diameter	Stevenson 1904:363-364, 1915:74
	He'-k'ia-pa he'-pa-lo-k'ia	Several smooth, thin baking-stones are heated. Meanwhile the [*he-we*] paste is thickly applied to the regular *he-we* stone, each sheet being taken off as soon as it is done enough to hold together and placed between a couple of the hot baking-slabs. An alternating pile of stones and thick *he'we* sheets is built up to the height of a foot or two, and allowed to stand until the steam, which at first pours out in volumes, begins to disappear.	Cushing 1920: 340-341
	He'-po-lo-li-we	A salty *he-we* rolled into heat little sticks or cylinders	Cushing 1920:337-338
	He'-tchi-kwa	A sweet *he-we* with a bright red color is made from the fine ground meal of red corn. Corn meal is boiled with the husks and shoots of red corn. Another variety is sweetened by mastication and fermentation	Cushing 1920: 340-341
	He-we (*Dowhewe*)	Maize is coarsely ground, then toasted in a bowl placed on stones in the fireplace and stirred continuously with sticks. The toasted meal is mixed with cold water and stirred into a pot of boiling water, which is stirred constantly. Once cooled, the mush is brought to the baking slab along with a bowl of batter of uncooked meal and cold water. Lime or ground amaranth are added for color blue or red coloring if desired. The batter and mush are combined in a new bowl and passed over the slab to make sheets	Stevenson 1904:362-363, 1915:73-74; Edaakie 1999:3
		A pot of thin paste (a mixture of hot water and fine flour of one or all the six varieties of corn) is set to cook. A bread bowl is nearly filled with a similar though thicker paste or batter made in cold water and placed near the left end of the griddle which is scoured with salt and greased. A small bowl of the sticky, cooked paste is set near the left end of the stone. The baker squats on her heels in front of the baking-stone, dips her closed fingers first into the hot, then into the cold paste, scooping up the right amount of each, and sweeps her hand along the surface of the stone, applying a thin, even layer of batter. Almost immediately the edges of the large sheet of paste, now slightly toasted, begin to roll up; then they are grasped at one side, slightly pulled and lifted and the large, almost transparent wafer placed on a plaited mat nearby	
		A variety of he-we made with cold boiled beans, pounded into paste with cold water which is rinsed with the batter in lieu of mush (along with salt)	Stevenson 1904: 363, 1915:74
		Untoasted corn meal is also sometimes used, with the addition of salt	Stevenson 1904: 363, 1915:74

G.2. Continued

Cooking Technique	Zuni Name	Recipe	Reference
Fried on Griddle (cont.)	*He'yahoniwe*	A thicker version of *he-we*, eaten warm. Cornmeal mush is ground twice and mixed with cold water and salt and boiled (slaked lime is added for color). A thick cake is formed by applying several layers of batter to the surface of the griddle before the sheet is withdrawn.	Cushing 1920:330; Stevenson 1915: 74
	K'os Hebatchi:we	Finely ground white corn flour is mixed with yeast and allowed to rise. The dough is formed into circular cakes that are roughened on one side and laid, rough-side down on a hot baking stone. The other side is also indented with fingertips and the whole is repeatedly turned until browned	Cushing 1920: 302
	K'os'-he'-we	Salt and lime-yeast are added to the [*he-we*] batter, and a liberal quantity of fat and salt is rubbed over the stone before baking	Cushing 1920:337-338
	N.D.	Griddle cakes made by cooking a mixture of fine and coarse meal blended with scalding water. The batter is poured over hot, well-polished slabs of sandstone	Cushing 1920: 255
	N.D.	Fine corn flour is mixed with lime-yeast and hot water to create a stiff batter. This is boiled until it becomes sticky and spread over a baking stone	Cushing 1920:301-302
	N.D.	The toasted meal of *he-we* fragments, ground finer, is cooked like batter and mixed with cold water and baked again on the stone. This results in a bread that tastes like delicate pie-crust	Cushing 1920: 339-340
	N.D.	This [k*'os hebatchi:we*] same dough, minus the yeast, and thinner, like batter, was used to make "johnny-cakes" or "corn-dodgers," which were baked on little flat stones at first well heated, then placed very near a hot fire	Cushing 1920: 302
Other	*Adeya: He'Balokya*	Washed blossoms stuffed with a batter of blue corn meal and water. Heat on a griddle with heavy plate or stone on top to flatten the cake	Allen 1995:30
	Pi'-k'ai-a	Water cress is boiled and eaten with other foods, the residues are each day made into flat, compact cakes, and dried with salt into greenish-black, very stemmy, and hard bricks, which were packed away for second cookings	Cushing 1920:226
	Thlem-mäthl-to-we	A thin corn mush boiled into a paste is then placed between two stones which are left in a cold place until frozen	Cushing 1920: 305
	N.D.	The unbaked batter of the *tchik-k'we-pa-lo-kia* is excessively boiled, then frozen to make a coarse "ice-cream"	Cushing 1920: 305
	N.D.	Corn meal is boiled in a small cooking pot and stirred to form a mush, which is then poured onto a stone and mixed with dry meal to form a dough that was wrapped around the end of a long stick and roasted over coals	Cushing 1920: 594-595