THE ORIGIN OF THE INITIAL FARMING POPULATION OF THE NORTHERN RIO GRANDE

by

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The Origin of the Initial Farming Population of the Northern Rio Grande

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This study looks at the origin of the initial farming population of the Northern Rio Grande through the evaluation of two contrasting hypotheses concerning the source areas of these migrants. Resolving the origin of the tenth century Northern Rio Grande population is important because the answer will shape current conversations around Tanoan language diversification, Eastern Pueblo migrations, and ultimately, Tewa origins.

The first hypothesis, which I call the ‘Southern Origin’ hypothesis, represents the predominant narrative and proposes that the most likely source of the early Tewa Basin population was agricultural communities of the Middle Rio Grande to the immediate south. Researchers developed this hypothesis primarily based on perceived continuities in material culture and the fact that the Middle Rio Grande was settled earlier in time than the Northern Rio Grande. The second hypothesis, which I call the ‘Northern Origin’ hypothesis, posits that the most likely source was Late Pueblo I and early Pueblo II agricultural communities within the Navajo Reservoir/Fruitland District located in northwestern New Mexico.

To evaluate these two hypotheses, I first established a set of expectations for each category of evidence based on assumptions intrinsic to each hypothesis. I then assessed how well each category of evidence met those expectations. The categories of evidence I looked at included population dynamics, material culture, and linguistic paleontology. These categories are most frequently cited in literature pertaining to Northern Rio Grande migrations.

I conclude that the Southern Origin hypothesis fails to provide the most compelling narrative for the origin of the initial farming population within the Northern Rio Grande. The existing evidence makes a strong case that Tewa-Tiwa diversification occurred within the San Juan drainage prior to AD 920 and that Tiwa speakers were likely located in the Northern Rio Grande by AD 980. In addition, based on the current data, the Middle Rio Grande lacked the growth rates and population outflows one would expect for a potential source area. Finally, at the very least, both population dynamics and material culture continuities do not rule out the Upper San Juan as a potential source area.

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INTRODUCTION

1.1 Research Question

In this paper, I will evaluate two competing hypotheses related to scholarly debates surrounding the origin of the initial farming population of the Northern Rio Grande at the beginning of the tenth century. The first hypothesis, which I call the 'Southern Origin' hypothesis, represents the predominant narrative and proposes that the most likely source of the early Northern Rio Grande population was agricultural communities within Middle Rio Grande to the immediate south (Boyer et al. 2010; Schillaci and Lakatos 2016, 2017). Researchers developed this hypothesis based primarily on perceived continuities in material culture (Boyer et al. 2010; Lakatos 2006, 2007; Lakatos and Post 2012; Schillaci and Lakatos 2017) and the fact that the Middle Rio Grande was settled earlier in time than the Northern Rio Grande (Boyer et al. 2010; Schillaci and Lakatos 2016).

The second hypothesis, which I call the 'Northern Origin' hypothesis, posits that the most likely source was Late Pueblo I and early Pueblo II agricultural communities within the San Juan drainage near present-day northwestern New Mexico. I selected this model based primarily on recent work by Ortman (2012), who advocated for a Tewa and Tiwa homeland within a subsection of the San Juan drainage known as the Upper San Juan. I also considered it due to previous archaeological studies that describe the Upper San Juan as having short occupational sequences, significant violence, and temporal abandonment patterns consonant with substantial out-migration around AD 900 (Potter et al. 2012; Wilshusen and Wilson 1995). Figure 1.1. references the principal regions and subregions referred to in this study.

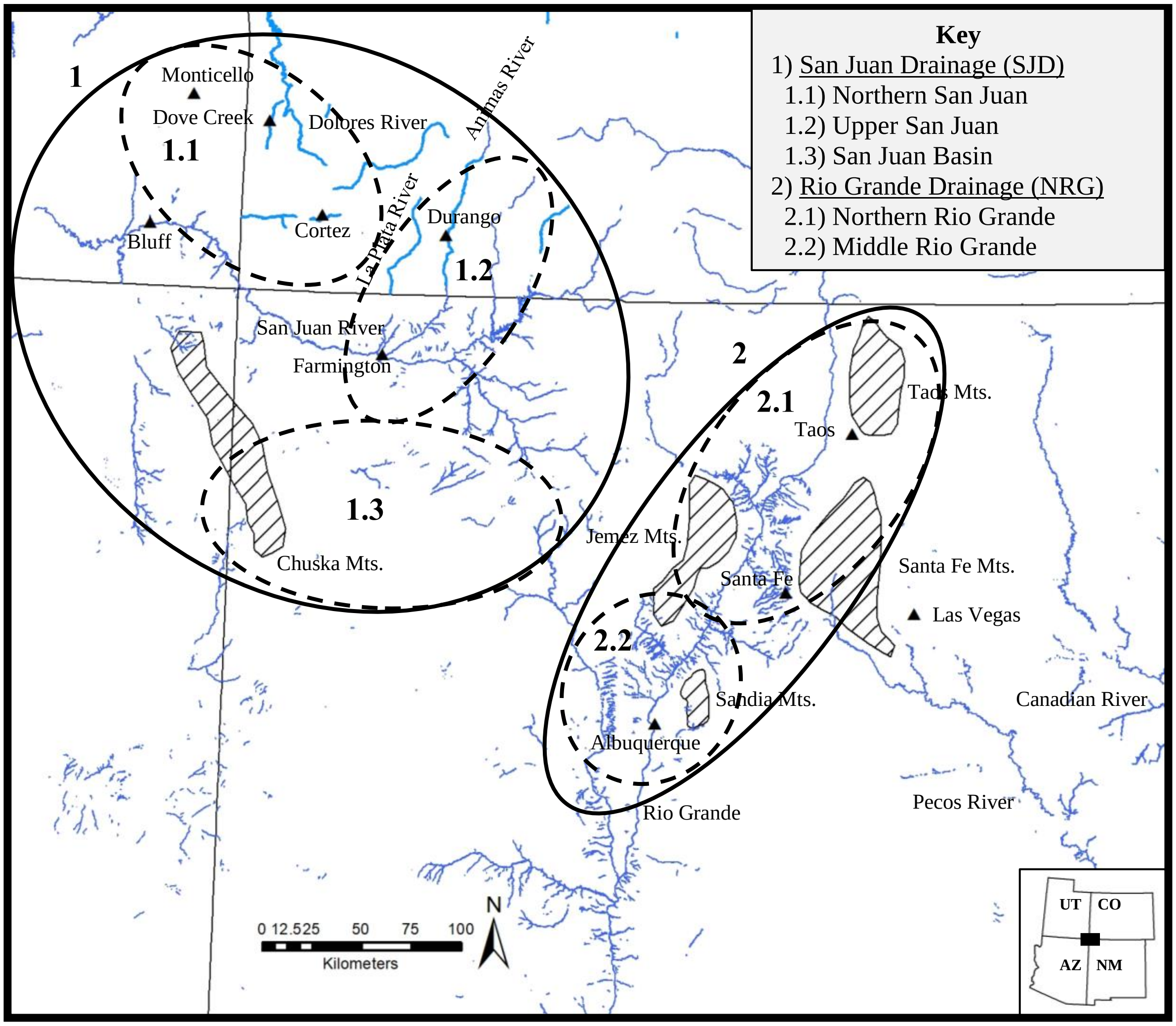

Figure 1.1 Principal Regions and Subregions Referenced in This Study

Traditionally, three principal models have been cited in literature pertaining to debates surrounding the origin of this farming population. The first is the 'in-situ hypothesis', which proposes that the primary mechanism of action driving tenth century population growth was intrinsic growth linked to the northerly movement of agricultural populations from the Middle Rio Grande into the Northern Rio Grande (Schillaci and Lakatos 2016). The second model is the 'small-scale immigration' hypothesis, which views small-scale population growth from the San

Juan Basin as representing a significant percentage of population growth within Northern Rio Grande from approximately AD 900 to 1100, after which migrants from the Mesa Verde region began to arrive (Schillaci and Lakatos 2016).

The third model is the ‘large-scale population movement’ hypothesis and it is best known in the context of debates surrounding thirteenth century migration from the Mesa Verde region into the Tewa Basin (Boyer et al. 2010; Lakatos 2006, 2007; Lakatos and Wilson 2012; Ortman 2012; Schillaci and Lakatos 2016, 2017; Schillaci et al. 2017; Ware 2016; Wilson 2013). This view posits that a large number of migrants (perhaps as many as 10,000) from the from the Mesa Verde region arrived in the Northern Rio Grande during the thirteenth century (Ortman 2012; Schillaci and Lakatos 2016). Recently, Schillaci and Lakatos (2016) have argued for a combination of both in-situ and longer term small-scale immigration based on their own population estimates, revised ceramic dating of Late Developmental (AD 900-1200) ware types, and the increased presence of Cibola white ware.

Northern Rio Grande population models are closely tied to questions in Southwestern archaeology about Tanoan language diversification and more specifically, the origin of the Tewa people of the Northern Rio Grande. As previously mentioned, the idea that Proto-Tiwa speakers entered the Northern Rio Grande from the San Juan drainage was most recently put forth by Ortman (2012) and is related to his larger hypothesis on Tewa origins. However, an opposing view, best represented by Boyer and others (2010), argues that the initial inhabitants of the Northern Rio Grande were Proto-Tiwa-Tewa[1] speaking migrants from one or more regions to the south/southwest, including the Rio San Jose Valley, the Rio Puerco (east) valley and the Middle

[1] The question as to whether Proto-Tiwa-Tewa was an actual subgroup, or instead were simply two adjacent dialects that separated has yet to be resolved. I will use the term Proto-Tiwa-Tewa following Ortman (2012).

Rio Grande (MRG), and that the Tiwa and Tewa languages diversified in-situ within the Rio Grande drainage.

Proponents of in-situ population models (Wendorf 1953, 1954; Wendorf and Reed 1955; Peckham in Ford et al. 1972; Boyer et al. 2010; Schillaci and Lakatos 2016, 2017; Schillaci et al. 2017) correlate Proto-Tiwa-Tewa diversification with the development of what they view as autochthonous ceramic types such as Kwahe'e Black-on-white (Schillaci and Lakatos 2017), continuity in pithouse architecture (Lakatos 2006, 2007) and the presence of Tewa-specific place names (Schillaci et al. 2017).

Given the multifaceted nature of this research question, it is important to emphasize that the Southern Origin hypothesis refers to any model that posits a southern origin for Proto-Tiwa-Tewa speakers and an in-situ diversification of Proto-Tiwa-Tewa. This includes both in-situ and small-scale immigration population models. The Northern Origin hypothesis refers to any model that posits a northern origin for Proto-Tiwa-Tewa speakers and a diversification of Proto-Tiwa-Tewa outside of the Northern Rio Grande. This includes the population model insofar as migration from outside the Rio Grande is assumed to represent the primary contribution to tenth century Northern Rio Grande population growth.

Resolving the origin of the tenth century Northern Rio Grande population is important because the answer will shape current conversations around Tanoan language diversification, Eastern Pueblo migrations, and ultimately, Tewa origins. If proponents of the Southern Origin hypothesis are correct in their belief that Proto-Tiwa-Tewa speakers diversified within the Tewa Basin, then many aspects of Ortman's (2012) hypothesis regarding Tewa origins may need to be reconsidered.

The results of my analyses should help identify the most probable location for an initial Proto-Tiwa-Tewa diversification as well as the most likely source area for a tenth century population influx in the Northern Rio Grande. I will conclude this paper by determining which of the two hypotheses best explains the lines of evidence analyzed and then identify promising future directions for additional research on this topic. Ultimately, my objective is to evaluate the ability of two competing hypotheses to explain the current body of evidence available related to the origin of the initial farming population in the Northern Rio Grande.

1.2 Theoretical Framework

To evaluate these hypotheses I will apply a framework presented in Fogelin (2007) for the evaluation of hypotheses called 'inference to the best explanation'. I have chosen Fogelin's (2007) framework because I believe that it is the best fit for an evaluation of hypotheses used in explaining complex socio-cultural phenomena like migration. In addition, similar to Fogelin (2007), I believe that such a framework reflects the type of reasoning that archaeologists actually employ regardless of their theoretical orientation.

I have selected 'inference to the best explanation' over processual alternatives described in Hempel (1965) and Fritz and Plog (1970) as well as postprocessual options described in Hodder (1986, 1999) primarily based on the following:

(1) According to the hypothetico-deductive (HO) method, testable hypotheses should be derived from underlying universal laws, which themselves have been tested and must be true (Fritz and Plog 1970). While there are many general statements about how human behavior manifests itself in the archaeological record that are often true, I have yet to see a universal law that has been tested to such a point that it is agreed upon by the intellectual community that no

exceptions to it exist (for clarification, an example of such a law in the natural sciences would be the law of gravity). Why is such testing important? Because, according to the HO method, a single exception will negate the law's validity and thus the entire hypothesis derived from it (Fogelin 2007). When 'black swans' appear, as they often do in the discipline, archaeologists typically do not throw their intellectual baby out with the bathwater, instead they simply revise their results in a way that produces a better 'fit' with their overall narrative (Fogelin 2007; Hodder 1999:30-65).

(2) The 'inference to the best explanation' framework avoids binary 'reject or accept' options in hypothesis testing. Instead, it provides a way to assess how effective a hypothesis is in explaining evidence – a hypothesis is either more or less effective than others in one's consideration set for a particular line of evidence. This is important for my research, as it reflects my intentions in terms of hypothesis evaluation. I do not intend to reject or accept hypotheses in the HO sense of the term. Instead, I intend to evaluate them based on their ability to explain multiple lines of evidence.

(3) The 'inference to the best explanation' framework avoids many of the critiques of postprocessual approaches by providing multiple criteria for determining whether a hypothesis is good or bad. Often, postprocessualist frameworks are critiqued based on their social constructivist nature using arguments that we cannot objectively 'know' anything and that one perspective is as good as another (Fogelin 2007). In fairness, it must be said that these criticisms may be more of a caricature of postprocessualist thought than a reflection of reality, as postprocessualist archaeologists do not typically say that in their own research.

How then should we decide which hypothesis in our consideration set is most compelling? According to Fogelin (2007), good explanations should meet the following criteria, or guidelines: (1) have empirical breadth; (2) be widely applicable; (3) be modest; (4) be refutable; (5) be conservative; (6) be simple; (7) account for multiple foils. However, these criteria are not set in stone; simply because an explanation does not meet all the above criteria does not mean it is a bad explanation. On the flip side, if what we deem to be the 'best' explanation falls short more often than not, then perhaps it is not a very good explanation (Fogelin 2007).

Considering all the above, I will move forward in my evaluation of the Southern Origin and Northern Origin hypotheses based on the following lines of evidence: population dynamics, material culture, and historical linguistics. I will present a priori expectations for each line of evidence according to each hypothesis for each category of evidence. Then, I will evaluate the data and summarize the results. Once I have assessed the data, I will conclude each section by stating whether each line of evidence supports or contradicts these expectations.

After evaluating the ability of each hypothesis to explain each individual line of evidence, I will select what I believe to be the 'best' hypothesis. In other words, I will select the hypothesis that presents the most coherent narrative and best explanation for the current evidence. As a last step, I will assess its effectiveness as a standalone explanation by assessing it against each of Fogelin's (2007) criteria. At the very least, this research should help us understand the strengths and weaknesses of each hypothesis, and ideally, will provide the best explanation for the evidence at hand.

1.3 Categories of Evidence

Population Dynamics. To analyze evidence related to population movement, I will use a correlative approach using estimates of absolute population numbers. Correlative approaches to population modeling look at both changes in the magnitude and shape of population in both the 'source' and 'target' locations. This can be contrasted with 'threshold' approaches, which only look at population changes within a single area (Ortman 2012:41). Correlative approaches have been used frequently when looking at population dynamics and migration patterns in the U.S. Southwest (Ortman 2012, 2016b; Potter 2010a; Potter et al. 2012; Wilshusen and Ortman 1999; Wilshusen and Van Dyke 2006). I will develop my own population model for a portion of the Upper San Juan drainage, and I will use this model to derive estimated absolute population numbers for the study area for the period between AD 800 and 900.

To complete my population dataset, I will use Boyer and others' (2010) published population estimates for the Middle Rio Grande and Northern Rio Grande. Using their data, I will calculate annual growth rates for the Northern Rio Grande to assess arguments for intrinsic growth as a primary factor in Northern Rio Grande tenth century migration. Then, I will use a measure called the juvenility index, or 15p5 ratio, to derive intrinsic growth rates for the Northern Rio Grande. 15p5 ratios have previously been used in both the Old World (Bocquet-Appel 2002; Bocquet-Appel and Naji 2006) and the New World (Kohler et al. 2008; Wilshusen and Perry 2008) to estimate intrinsic growth rates for specific populations.

Material Culture. To analyze evidence related to material culture, I will look at both pithouse architecture and ceramic assemblages for a sample of sites in the Upper San Juan and Middle Rio Grande during the mid-to-late Early Developmental period (AD 600-900), and the Northern Rio Grande during the first part of the Late Developmental period (AD 900-1200). Both lines of evidence have been extensively cited in support of the Southern Origin hypothesis (Boyer et al. 2010; Lakatos 2006, 2007; Lakatos and Wilson 2012; Wilson 2013; Schillaci and

Lakatos 2016; Schillaci et al. 2017) and a comparison of material culture from all regions should help in assessing likely source destinations.

I will first develop ceramic profiles for representative sites from the Upper San Juan and Middle Rio Grande region to serve as a baseline and then I will compare them to ceramic profiles from the Northern Rio Grande. For pithouse architecture, I will follow methodologies outlined in Lakatos (2006, 2007) and calculate frequencies for a series of attributes for a sample of pithouses from the Upper San Juan. Using specific attributes listed in Lakatos and Wilson (2012), I will compare these frequencies with those listed in Lakatos (2006, 2007) for the Middle Rio Grande and Northern Rio Grande. Ideally, comparing material culture should help illustrate important cultural continuities or discontinuities across subregions.

Linguistic Paleontology. To analyze evidence from linguistic paleontology, I will summarize research on Tanoan language diversification, with a focus on Proto-Tiwa-Tewa. In addition, I will incorporate information on oral traditions and native toponyms germane to this topic. There have been many attempts at correlating Tanoan languages and prehistoric cultures within the Rio Grande (Mera 1935; Reed 1949; Wendorf 1954; Wendorf and Reed 1955; Ford et al. 1972; Boyer et al. 2010; Schillaci and Lakatos 2016, 2017; Schillaci et al. 2017; Shaul 2014, 2018), but there has yet to be a concise summary of the literature with an orientation toward a tenth century Northern Rio Grande migration, despite its importance to the larger debate on Tewa origins.

1.4 Expectations: Northern Origin and Southern Origin Hypotheses

Although archaeologists cannot presume to know exactly how people chose to express their identity (or not) in the material record, we can form plausible expectations based on our own prejudgments. According to Hodder (1999:30-65), archaeologists derive prejudgments from the interplay of a multitude of factors (theoretical assumptions, methodological preferences, specific skills, social dynamics, etc.) that are intertwined in their disciplinary upbringing. In turn, he believes that these prejudgments shape archaeologists' expectations about what they *should* see in the archaeological record. For example, Hodder (1999:32-44) mentions that his own pre-understandings about how a Neolithic site should 'look' were rooted in long held assumptions about social complexity and Neolithic social behavior, which conditioned how he interpreted the data at the Haddenham causewayed enclosure. Later, multiple incongruences between Hodder's (1999) initial prejudgments and the data forced him to reevaluate his narrative.

While all archaeologists bring a set of prejudgments to every archaeological site (whether or not they like to admit it), it is important to be aware that these prejudgments can bias interpretations of the data. Furthermore, if disjunctions between prejudgments and data become too large, then alternative hypotheses that weave various lines of evidences into a more coherent, compelling narrative need to be considered. Based on the below prejudgments, I will develop a set of expectations for each category of evidence against which to weigh the data.

Adherents of the Southern and Northern origin hypotheses bring their own prejudgments and expectations to each line of evidence. The Southern Origin hypothesis adheres to a traditional view of migration in archaeology, which is classically represented by the work of Di Peso (1958) and Haury (1986[1958]); thus, the presence of clear discontinuities in material culture (i.e., site-unit intrusions) represent *prima facie* evidence of migration. Such a dichotomization of the archeological record makes sense when one understands the prejudgments that Southern Origin proponents bring to the question of migration.

One example of Southern Origin prejudgments is that the material culture in the Northern San Juan is so different from that of the Northern Rio Grande that the arrival of migrants from the Northern San Juan would be immediately apparent. Another is that archaeologists have underestimated Developmental population numbers. A third is that there is a one-to-one mapping of language and culture, such that the presence of one necessitates the presence of another. As Southern Origin proponents have not publicly commented on the feasibility of an Upper San Juan migration into the Northern Rio Grande, I will use their arguments against a thirteenth century migration to frame their expectations for each line of evidence. Regardless of the time period involved, their underlying assumptions and prejudgments should not change.

The Northern Origin hypothesis adheres to a more nuanced view of migration, which regards the material record as a reflection of underlying active social discourses on the cultural milieu in which people find themselves. In this framework, an absence of clear site-unit intrusions does not *necessarily* indicate an absence of migration – migrants may simply choose not to express their identity in ways that archaeologists expect (Ortman 2012:336-350). Factors such as migration rate, size, and sociopolitical organization can all impact migrants' decisions to maintain certain elements of their homeland material culture and jettison others (Stone and Lipe 2011).

While the Northern Origin's application of a more nuanced framework for migration would not necessarily require the establishment of a priori hypotheses per se, migratory frameworks are not created in isolation. Instead, they are shaped by the prejudgments that archaeologists bring to every research question. Northern Origin prejudgments are rooted in previous work on cultural, linguistic and ethnic divisions between the Northern San Juan and Upper San Juan. Many scholars have argued for some sort of cultural divide between those living on the east side of the La Plata River and those living on the west side based on distinct differences in pithouse architecture, ceramic traditions, settlement patterns, perishables and/or linguistic differences (Chuipka and Hovezak 2008; Hovezak and Sesler 2002a; Ortman 2012; Potter 2010a; Wilshusen and Ortman 1999; Webster 2009, 2012).

In addition, Severin Fowles (2013:75-100) argues for a tenth century migration of Upper San Juan peoples from the Piedra district, located north of the Navajo Reservoir near Chimney Rock, into the Taos Valley. Fowles (2013) bases his analysis on similarities in unpainted utility ware, and existing craniometric (Schillaci et al. 2001) and population studies (Eddy 1977; Parker 2004). Fowles (2013) points out that these migrants carried with them a distinctly ‘anti-Chaco’ material culture that he believes was an active commentary on their willingness to disengage with the burgeoning Chacoan sphere of influence taking root west of the La Plata River. The above assertions help shape my own expectations for each category of evidence for the Northern Origin hypothesis.

Regardless of prejudgments, all perspectives on the initial farming population of the Northern Rio Grande are presented within a framework of migration. While a comprehensive review of migration literature is outside the scope of this paper, I believe it is important to contextualize hypotheses surrounding a potential Upper San Juan-Northern Rio Grande migration within the larger conversation around migration as an explanatory framework for culture change. Once the theoretical background has been established, we can then look at how migration theory specifically relates to evidence linked to material culture.

In the following chapter I will first present an overview of the theory of migration as it relates to archaeological scholarship. Then, I will review of previous research on Rio Grande migrations.

CHAPTER 2

BACKGROUND

2.1 Migration

Migration has made a comeback among archaeologists after a period of relative ignominy bestowed upon it by the New Archaeology movement of the 1960s and 1970s due to its inextricable links with an approach to understanding the past known as 'culture history' (Cabana 2011; Cameron 1995). The roots of culture history go back to a European intellectual movement known as Romanticism that began in the 18th century. Romanticism evolved as an intellectual counterweight to the Enlightenment, critiquing it for applying nomothetic laws to human behavior. Romanticists believed that human behavior was derived from innate human creativity and groups of people expressed this creativity differently in accordance with their own unique mental template. This mental template was crafted through a shared history and if one was to understand human behavior of a particular group, then one needed to intimately understand what made that group unique (Urban and Schortman 2012:75).

Thus, culture history builds from a 'normative' view of culture, as culture simply reflected norms contained in people's heads. In the context of archaeology, these norms are expressed through the material record and collections of archaeological traits were assumed to represent unique prehistoric cultural groups. In the words of V. Gordon Childe (1929:v-vi), one of the most well-known 20th century proponents of culture history: "A word or two must be said on archaeological concepts. We find certain types of remains – pots, implements, ornaments, burial rites, house forms – constantly recurring together. Such a complex of regularly associated traits we shall term a 'culture group' or just a 'culture'. We assume that such a complex is the material expression of what would to-day be called 'people'".

As these cultural groups availed themselves of the same mental template, cultural change was assumed to derive primarily from external forces. Diffusion of ideas through group-to-group contact and migration of people from one place to another were viewed as the primary impetus of culture change. Prehistory was essentially sketched out through chronological frameworks depicting the transition of one culture group to another through time and space, with episodes of diffusion and migration identified where applicable. This framework was inherently descriptive and not explanatory; we knew *where* culture change occurred but we did not know *why* (Johnson 2010:17-21).

With the advent of the New Archaeology movement, this normative view of culture change was "considered inadequate for the generation of fruitful explanatory hypotheses of cultural process" (Binford 1965:209) due to its inability to explain culture change through the establishment of nomothetic laws, a requirement to qualify as 'science' (Adams et al. 1978; Cabana 2011; Cameron 1995). In his seminal article on migration, Anthony (1990) emphasizes that despite initial attempts in the United States at establishing methods for identifying migration in the archaeological record (Haury 1986[1958]; Rouse 1958), archaeologists were unable to adequately develop a general theory from which such methods could be drawn.

Migration was swept up in a much larger critique of the assumptions behind culture-historical frameworks (i.e., the link between groups of cultural traits and past peoples) by New Archaeology acolytes such as Lewis Binford (1962, 1964) and David Clarke (1973) who advocated for the use of a more processual archaeology modeled on the hard sciences to derive generalized explanations for culture change. Archaeologists advocated for the implementation of the Hempel-Oppenheim (HO) model of scientific explanation, which relied on deductive rather than inductive logic. Rather than assume an empiricist viewpoint and expect the archaeological data to speak for themselves, an HO model assumes a logical positivist viewpoint that requires establishing and testing hypotheses to empirically determine the validity of a particular explanation (Johnson 2011; Fritz and Plog 1970). Since migration was considered explicative and not explanatory in nature, it was deemed of little value in assessing culture change (Binford 1964).

The arrival of postprocessual archaeology during the 1980s and 1990s allowed archaeologists the theoretical freedom to take another look at migration as an explanation for culture change (Cameron 1995; Cabana 2011). In their overview of migration theory in archaeology, Chapman and Hamerow (1997:4) describe this freedom as, “The rejection of the Holy Trinity of processual archaeology – logical positivism, universal laws and systems theory – frees postprocessualists to investigate long-term cultural sequences in terms of changes in the structure of meaning at the heart of social groups”. The expectation among many archaeologists is that prehistoric migrations are structured phenomena that should produce identifiable patterns in the archaeological record (Anthony 1990; Clark 2001, 2004).

These patterns are usually identified as ‘site-unit intrusions’ that “refer to a site which is clearly representative of a culture other than the dominant culture in a particular geographic area” (Cameron 1995:108). Site-unit intrusions (understood as an intrusive cultural complex) in turn are interpreted as manifestations of ethnic identity (Hodder 1977, 1979). The manifestation of ethnic identity through material culture (often identified as *style)* can take multiple forms. Postprocessual archaeologists view material culture as part of social practice that both influences and is influenced by human agency through the day-to-day practice of shared cultural norms

(Jones 1997). This draws on the idea of ‘habitus’, as espoused by Bourdieu (1977) and ‘structuration’ as espoused by Giddens (1984), in which the relationship between social structures and the day-to-day practice of cultural norms, mediated by habitus, or unconscious cultural competence, inculcates material culture with meaning (Hodder 1986:74-79).

One of the more important debates in archaeology during the 1980s revolved around whether this manifestation occurred actively as part of an overt signaling process (Barth 1969; Wiessner 1983; Wobst 1977) or in a much more subdued way, as part of isochrestic variation related to functional choices (Sackett 1977). Archaeologists have also questioned the feasibility of identifying homogenous, bounded ethnic entities in the archaeological record. The way ethnicity is expressed through material culture is context-dependent and highly complex and while it is patterned, one cannot assume a priori that cultural continuity in material culture necessarily reflects migration, shared norms, or inter-group interaction (Jones 1997:140).

Placing the quandary of the identification of ethnicity in the archaeological record aside for a moment, it is important to return to a more traditional view for some historical context. A classic example of a traditional view of migration in the Southwest is Emil Haury's (1986[1958]) work at Point of Pines, Arizona. In his work, Haury (1986[1958]) identified site-unit intrusions primarily based on architecture that he linked to a thirteenth century migration of people from the Kayenta-Hopi region in the northern part of the state. Di Peso's (1958) work at Reeve Ruin, Arizona is another well-known example of the identification of site-unit intrusions representative of migration in the U.S. Southwest.

Outside of the U.S. Southwest, additional examples of site-unit intrusion interpreted as migration include Spence's (1992, 1994) work on the Oaxaca Barrio at Teotihuacan and Ritterbush and Logan's (2000) identification of a cultural complex on the central Plains linked to the Oneota tradition of the upper Midwest. While Ritterbush and Logan (2000) focus on tool inventories and ceramics as their primary lines of evidence, Spence's (1992, 1994) Mesoamerican context allowed him to expand his analysis to include tombs, funerary offerings, and biological data.

While material correlates of migration can appear via site-unit intrusions in both public and private spaces, Clark (2001, 2004) argues that archaeologists should look to the domestic sphere rather than the public one. In advocating for the domestic sphere, Clark (2001, 2004) avails himself of the arguments made by Christopher Carr (1995) on artifact attribute design. According to Carr (1995:195-198), the more physically and contextually obscure the attribute, the more likely it represents a shared cultural background. Following Carr (1995:195-198), Clark (2001, 2004) believes that the domestic sphere is the most likely context in which archaeologists can find such enculturated assemblages and provides datasets derived from ethnoarchaeological and ethnographic case studies to support Carr's (1995:Table 7.5) model.

Clark (2001, 2004) asserts that artifacts that are nondescript, less visible, and innocuous are more likely to contain enculturative information. In arguing for the importance of emphasizing enculturation over emulation, Clark (2001, 2004) mentions that emulation can result in the presence of material culture at an archaeological site *without* a corresponding population movement. Enculturation, on the other hand, refers to the transmission of deeply embedded cultural norms that relate to specific social identity. Therefore, site-unit intrusions with artifact assemblages that contain information on enculturated norms are the best indicators of migration.

Burmeister (2000:542) similarly underlines the importance of the "internal domain" when attempting to identify material correlates of migration. Burmeister (2000) proposes that the cultural habitus of an ethnic group is more apt to survive within a domestic context, as there are fewer pressures to conform to external standards. In a critique of both Barth (1969) and Bourdieu (1977), Stone (2003) believes that neither Bourdieu (1977) nor Barth (1969) accurately conceptualize how ethnic identity is manifested. Instead, Stone (2003) melds Gidden's (1984) idea of structuration and Bourdieu's (1977) idea of intra-societal habitus differentiation with Pauketat's (2001) historical-processualism in arguing that individuals do have control over how they consciously express ethic identity, but that this expression is tempered and shaped by multiple factors such as structural constraints, unequal power dynamics, and history. Migration is often conceptualized as a "conscious social strategy meant to improve the migrant's position in competition for status and riches" (Anthony 2007:111). Since the expression of ethnic identity through the archaeological record is conditioned by a complex web of social and environmental factors in both the source and target locations, the application of standard migratory frameworks can quickly become problematic (Stone and Lipe 2011).

Stone (2003) and Ortman and Cameron (2011) stress the importance of considering both low and high-visibility attributes at multiple scales of analysis when studying migration. Ortman and Cameron (2011) cite Ortman's (2008) work on similarities in shrine placement between Northern San Juan and Northern Rio Grande villages as an example of a high-visibility attribute that Clark's (2001, 2004) model would have eschewed, but ultimately revealed itself as an important line of evidence supporting cultural continuity between the two regions. What this means is that low-visibility attributes in one cultural context may quickly transform into high-visibility attributes in another cultural context or fade away altogether (Ortman 2012:253-263). Ortman (2012:253-263) emphasizes that while clear site-intrusions can be convincing evidence for migration, the absence of site-intrusions does not necessarily mean absence of migration.

In doing so, Ortman (2012:253-263) underlines the point that material culture does not always map onto speech communities and biological groups the same way. While heterogeneity in material culture may be a line of evidence in support of migration, homogeneity in material culture does not always signify the absence of migration. One of the more cited examples of this in the U.S. Southwest is the Hopi-Tewa of Arizona, in which two different language groups (Hopi and Tewa) lived side-by-side in such a way that even though they were ethnically separate, they were archaeologically indistinguishable (Dozier 1954).

Additional examples of this logical conundrum appear outside of the U.S. Southwest as well. While arrow-point style was found to correlate with language groups among the San hunter-gatherers of South Africa (Wiessner 1983), the distribution of a specific type of arrow point called a ‘Madison-type’ was not significantly correlated with either Iroquoian or Algonkian speakers(Anthony 2007:103). As the much repeated quote “pots do not equal people” suggests, archaeologists generally agree that there is no predictable correlation between material culture and language/ethnicity (Anthony 2007:103).

Finally, Ortman (2012:257) challenges the assumption that migrants actively choose to continue material culture traditions linked to their homeland when involved in long-distance movement from a source location into a relatively lightly populated target location. In fact, Ortman (2012:257) asserts the opposite, that the greater the influence migrants exert on the target location, the greater their flexibility in choosing how to express their ethnic identity. Depending on the choices migrants make, this may or may not result in the continuity of material culture. Thus, instead of maintaining source-specific material culture traditions, they may choose to express their ethnic identity linguistically and through their shared migratory experience and adapt material culture traditions more in line with the social and cultural context of the target location.

This argument draws on Pauketat's (2008:239) idea of "community as hybridity", in which historical contingency shapes novel material culture recombinations. Pauketat (2008:248) uses the word "tesserae" after Robb (1998) to describe his framework for understanding the relationship between agency and structure. While Robb (1998) refers to 'tesserae' to describe the fractal and arbitrary nature of symbols as a counter point to traditional practice theory frameworks (Bourdieu 1977; Giddens 1984), Pauketat (2008) believes that this is also a better description of the impact of historical contingencies on agency, structure and community than normative ideas of agency and structure as espoused by Giddens (1984). Ultimately, this means that the concept of migration should be thought of a dynamic one and that the interplay between agency and structure is shaped by unique historical forces, the results of which cannot always be predicted.

If archaeologists choose to view migration as an explanation for culture change, then simplistic 'presence/absence' models (Di Peso 1958; Haury 1986[1956]) that avail themselves of select material correlates would theoretically be sufficient for these purposes. However, the reality is that many archaeologists now conceptualize migration as a social act that crosses multiple boundaries (linguistic, territorial, social, etc.) at various levels (Cabana and Clark 2011). In other words, migration is a decision that is not made in a vacuum, but is embedded within political, social, and economical structural realities (Beekman and Christensen 2011). Such a complex social phenomenon requires a more sophisticated framework than unidimensional 'presence/absence' models can offer. We cannot simply assume that cultural traits map directly onto ethnic identity. The view that migration is an explanation of a pattern in the archaeological record is the wrong approach; instead, migration should be viewed as a reaction to a complex socio-cultural web of factors that can reverberate across multiple areas of society in many different manifestations. As such, archaeological evidence alone is often insufficient to definitively prove or disprove migration, and multiple lines of evidence need to be brought to bear on the question (Rouse 1986:13-18, 179; Beekman and Christensen 2003; Stone 2003; Ortman 2012:368).

In their article on Mesoamerican Nahua migrations, Beekman and Christensen (2003) argue that archaeology can make an important contribution to migration theory, but not through the identification of material correlates; instead, a meaningful contribution will be made using archaeology's unique long-term perspective coupled with a multidisciplinary approach. Beekman and Christensen (2003:115) state that "essentialist templates" of migration lack the context necessary to detect migration from all but the most obvious cases.

A few of the more cited examples of the application of multidisciplinary approaches to the study of migration in the Old World include Renfrew's (1987) and Mallory's (1989) work on Indo-European origins. In North America, notable studies include Greenberg and others' (1986) study of the settlement of the Americas, Madsen and Rhode's (1994) edited volume on Numic migration, Ortman's (2012) study of Tewa origins, Shaul's (2014) analysis of Uto-Aztecan, and the work done by both Fowler (1989) and Beekman and Christensen (2003) on Nahua migrations in Mesoamerica. One of the most well-known systematic approaches to migration is Ammerman and Cavalli-Sforza's (1973) Wave of Advance model, which they proposed as an explanation for the spread of early farming in Europe, while other variants of systematic approaches have also been used (Collett 1982; Terrell 1986). Ultimately, the plethora of migratory frameworks discussed here demonstrate that migration can be expressed through multiple channels and in multiple ways, and that multidisciplinary approaches tend to be better suited to exploring it (Beekman and Christensen 2003).

How does all of this relate to my own evaluation of the Northern Origin and Southern Origin models? As there were very few people living within the Northern Rio Grande by AD 900, and thousands of them by AD 1000, we know that migration occurred. The question really boils down to identifying the best framework for investigating alternative migration models. Given the above, it is safe to say that a unidimensional model that focuses exclusively on the presence of site-unit intrusions as evidence of migration, and the absence as evidence against migration, is inadequate. However, this does not mean that we cannot compare material culture in the source and target areas and use such a comparison as a line of evidence when evaluating competing hypotheses. What we should not do is jump to conclusions based on evaluating the material record against a priori expectations rooted in essentialist frameworks. What we should do is include a comparison of material culture as an individual line of evidence in a multidisciplinary framework and then interpret it (and perhaps re-interpret it) based on its fit and coherence with other lines of data. Ideally, the result of such reasoning would reveal the best hypothesis (i.e., explanation) for the breadth and depth of evidence brought to bear on the research question at hand.

Before presenting the results of my data analysis, it is critical that the reader have a firm understanding of previous research conducted on Rio Grande migration and Proto-Tiwa-Tewa language diversification. As most of the research on Tanoan languages has centered around the investigation of Tewa origins, I will outline a brief history of archaeological research on this topic and its relation to the broader question of the depopulation of the Mesa Verde region during the thirteenth century. I will then link this argument to my own research on Proto-Tiwa-Tewa diversification. In doing so, I will discuss the three principal hypotheses presented regarding Tewa origins and step the reader through the main arguments that archaeologists have used to investigate the topic. A more detailed version of these arguments can be found in both Ortman (2012) and Ware (2016).

2.2 History of Archaeological Research on Rio Grande Migrations

Early Studies. The abandonment of the Mesa Verde region in the thirteenth century and the contemporaneous growth of population in the Northern Rio Grande are two questions that have vexed Southwestern archaeologists for over a century. Key to this problem is making sense of the incongruous nature of the multiple lines of data that have been brought to bear on the issue. Alfred Kidder (1924) was the first to seriously consider the archaeological evidence of Tewa origins (Ortman 2012) and proposed the small-scale immigration hypothesis based on a combination of population growth in the Northern Rio Grande coupled with continuity in material culture. To address the lack of clear site-unit intrusions, Kidder (1924:342) remarked, "It would seem that the transference of people must have been by small groups, rather than by whole communities, an infiltration rather than a migration".

In his work across multiple sites in the Northern Rio Grande, H. P. Mera (1935) viewed Developmental pottery types such as Red Mesa Black-on-white and Kwahe'e Black-on-white as signs of a possible migration from the Chaco region, but that later ceramic sequences consisting of Santa Fe Black-on-white, Wiyo Black-on-white, and Biscuit wares in Tanoan speaking regions were developed locally due to similarities in production and design. Mera (1935) also attempted to overlay language genealogies onto ceramic genealogies in his analysis of Northern Rio Grande ceramic developmental sequences.

After Mera (1935), Eric Reed's (1949) work was the next important contribution to the study of Tewa origins (Ortman 2012; Ware 2016). Similar to Mera, (1935), Reed (1949) correlated material culture change with change in Tanoan languages through time, but his interpretations led him to adhere to the small-scale immigration hypothesis rather than the in-situ development hypothesis. Reed (1949) thought that Tanoan language divergence corresponded nicely with changes in Ancestral Puebloan cultural sequences, culminating with the arrival of Tewa speaking migrants into the Northern Rio Grande in the thirteenth century.

In a subsequent article, Reed shifted his thinking and collaborated with Wendorf in focusing on a lack of clear site-unit intrusions representative of a Northern San Juan migration. Wendorf and Reed (1955:161) posited a small-scale tenth century Chacoan population incursion into the Northern Rio Grande, but did not see any evidence of a large-scale thirteenth century migration, stating "...there are no features in early Historic Period Tewa sites, or their earlier counterparts, which could be ascribed to the Mesa Verde immigrants; rather, there is a noticeable lack of the specialized Mesa Verde features in Tewa sites".

Charles McNutt (1969:109) largely agreed with Wendorf and Reed (1955) in that archaeological similarities between tenth century Northern Rio Grande ceramics and Chaco-San Juan styles strongly support multiple, small-scale migrations of people from the "Chaco-San Juan" region into the Middle Rio Grande sometime after AD 750. McNutt (1969) based this date on parallels between San Marcial Black-on-white and a late Basketmaker III/Early Pueblo I ceramic type known as White Mound Black-on-white found in the Chaco-San Juan region.

However, contrary to Wendorf and Reed (1955), McNutt (1969:106-107) argued that the transition from mineral-based paint, represented by Kwahe'e Black-on-white, to carbon-based paint, represented by Santa Fe Black-on-white, in the Northern Rio Grande during the Early

Coalition happened too quickly to be autochthonous in nature and must have represented additional migration from the Northern San Juan (see Ortman 2012 for a similar argument). McNutt (1969:116-117) identified additional changes in the archaeological record that he believed to be indicative of a thirteenth century Mesa Verde migration, including a shift from trough metates to slab metates, a shift from side-notch points to corner-notch points, the appearance of fully grooved partially polished axes, and the appearance of turkey bones.

Similar to Reed (1949) and Mera (1935), Ford and others (1972) also attempted to correlate language groups with the archaeological record in their analysis of Northern Rio Grande pottery sequences. The authors agreed that the Tiwa originally resided in the Northern San Juan area; however, they had significant differences regarding their understanding of Tewa origins. Ultimately, Schroeder and Ford believed that the Tewa originally resided in the Northern San Juan area and later migrated into the Northern Rio Grande around AD1000, while Peckham disagreed and believed that the Tewa developed organically in the Northern Rio Grande, separating from each other around AD 900.

Recent Studies. Paleodemographic studies have established that there was a significant decrease in population in the Mesa Verde region in the thirteenth century contemporaneous with a similar increase in population in the Northern Rio Grande region (Hill et al. 2010; Ortman 2012, 2016b; but see Boyer et al. 2010; Schillaci and Lakatos 2016). Furthermore, paleoclimatic studies tentatively support traditional ‘push/pull’ frameworks used to study Mesa Verde-Northern Rio Grande migration hypotheses (Cordell et al. 2007; Wright 2010). There is also evidence for established long-distance connections between the Mesa Verde region and the Northern Rio Grande dating back to the Developmental period (AD 900-1200), as evidenced by obsidian sourcing (Arakawa et al. 2011; Ortman 2012:268-273) and similarities in Northern Rio

Grande ceramic styles such as Red Mesa Black-on-white, Kwahe'e Black-on-white, Galisteo Black-on-white and Santa Fe Black-on-white with northern styles such as Cortez Black-on-white, Mancos Black-on-white, Mesa Verde Black-on-white and McElmo Black-on-white (Cordell et al. 2007; Washburn 2013).

Others believe that these ceramic types developed in-situ within the Northern Rio Grande (Boyer et al. 2010; Lakatos and Wilson 2012; Schillaci and Lakatos 2017) due to revised dating of both Kwahe'e Black-on-white and Santa Fe Black-on-white (Schillaci and Lakatos 2017). Arguments have also been made for in-situ development (Lakatos 2006, 2007) based on continuities in pithouse architecture and the association of Tewa place names with tenth century archaeological sites within the Northern Rio Grande (Schillaci et al. 2017). Of course, substantial counter arguments regarding place names and Tanoan language diversification have also been made by Ortman (2010, 2012:172-202), Ortman and McNeil (2017).

In addition to material culture, population trends and language, craniometric studies have also been used to substantiate assumptions about connections between the Northern Rio Grande and both the southern San Juan (Schillaci et al. 2001; Schillaci 2003) and the Mesa Verde region (Ortman 2012). Recently, Kemp and others (2017) have suggested that continuity in mtDNA between Mesa Verde and the Northern Rio Grande domesticated turkey populations during the thirteenth century supports a Mesa Verde-Northern Rio Grande migration.

Furthermore, Tewa oral traditions and place names also generally support a 'northern' origin for ancestral Tewa populations (Dozier 1970; Harrington 1919; Jeançon and Roberts 1924; Ortman 2010, 2012:187-202), but recent work by Schillaci and others (2017) provides some evidence that Tewa may have been spoken in the Northern Rio Grande beginning in the tenth century. Despite the aforementioned evidence, the biggest hurdle confronting archaeologists is the lack of clear site-unit intrusions in the Northern Rio Grande. Such incongruences between scholarly expectations and manifestations in the archaeological record have baffled archaeologists since the early twentieth century.

Over the next three chapters I will present my own analysis of population dynamics, material culture, and linguistic paleontology as they relate to the origin of the initial farming population of the Northern Rio Grande. For each line of evidence, I will first summarize the research that has been conducted to-date. Then, I will discuss expectations for each hypothesis and walk the reader through my data analysis. I will conclude each chapter by assessing the results of my analysis and discuss their implications for the evaluation of the Northern Origin and Southern Origin hypotheses.

CHAPTER 3

POPULATION DYNAMICS

3.1 The Importance of Population and Demography in Understanding Prehistory

It has been argued that if the ultimate goal of archaeology is to explain culture change, then an understanding of population and demography is the most important factor to consider (Shennan 2000). From a culture history perspective, many of the most significant events of prehistory have been intertwined with demographic shifts (Nelson et al. 1994). Whether or not you agree that explaining culture change is the primary goal of archaeology, there is a general consensus among archaeologists that an understanding of paleodemography and population dynamics is a critical component of many of the most pressing archaeological questions today (Kintigh et al. 2014; Kulisheck 2016). The search for cause and explanation of long-term cultural processes remains a core component of archaeological research and are inextricably linked to future disciplinary challenges. Along with historical ecology, demography and movement have been cited as key themes in the quest to address these challenges (Ramenofsky and Herhahn 2016).

There may be no area where population matters more than the study of migration (Ortman 2016a). The distribution of material culture is linked to the movement of people and the movement of people is linked to the distribution of material culture, so inevitably the study of one must involve the study of the other (Huntley et al. 2016). The U.S. Southwest is particularly good for the development of population estimates due to the sheer volume of archaeological research undertaken in the region, excellent preservation of the material record, and chronological control through the use of tree-ring dating (Cowgill 2000; Kulisheck 2016).

Archaeological attempts at population reconstruction in the U.S. Southwest go back to the 1970s with Jeffrey Dean's (1970) work on Tsegi Phase social organization (Kulisheck 2016). Later attempts include Ricky Lightfoot's (1994) research at the Duckfoot site in southwestern Colorado and Wilshusen and Wilson's (1995) analysis of the Cedar Hill area of northwestern New Mexico. Population estimates by Ortman and others (2007) and Ortman (2012:57-86, 2016b) demonstrated more advanced techniques when faced with less thoroughly investigated archaeological contexts. Population estimates have also been integrated into larger-scale research on critical Puebloan "hinge points" (Kantner 2004:14), or periods of accelerated culture change. Some of the most well-known examples of these types of studies include work on complex adaptive systems in the Mesa Verde region (Kohler 2010; Kohler et al. 2007; Kohler and Varien 2012; Varien et al. 2007), Wilcox and others' (2007) study of southwestern settlement patterns and organizational scale, and Hill and others' (2010) analysis of Hohokam population decline.

There may be no more famous example in North America of the link between population movement, migration and archaeological 'hinge points' than discussions around the thirteenth century exodus of people out of the Mesa Verde region. As previously mentioned, correlative approaches have been applied, most notably by Ortman (2012), in arguing that inter-regional population dynamics between the Mesa Verde region and the Northern Rio Grande suggest the Northern Rio Grande as the most likely source location for the thousands of immigrants leaving Mesa Verde during this period.

When thinking about prehistoric population dynamics, it is important to distinguish between demographic studies and population studies. Population refers simply to the number of people living at any given moment in a specified location, while demography focuses on the underlying structural components of said population (i.e., gender, age, health, etc.). Since demographic variables directly contribute to changes in population size and population dynamics are a critical component of understanding culture change, archaeologists must strive to accurately assess these underlying demographic metrics to construct better arguments about culture change (Kulisheck 2016).

Recently, there has been some debate surrounding the value of relative population estimates versus absolute population estimates with regards to their usefulness in understanding culture change (Kulisheck 2016; Ortman 2016a). For example, relative population estimates might compare the number of households in a period with that of the previous period, while absolute population estimates would calculate actual numbers associated with these households. Ortman (2016a) argues that while relative population estimates can provide some useful information, quantifying the number of people who lived in different regions is indispensable to developing a better understanding of the social impact of population movements at multiple scales. Furthermore, translating proxies for population into actual population numbers facilitates cross-regional comparisons, as absolute estimates for different regions are converted into a common denominator – number of people. The ability to engage in cross-regional comparisons using absolute population estimates can help archaeologists investigate many of the grand challenges facing the discipline (Kulisheck 2016)

In addition, absolute population estimates can be incorporated into multiscalar archaeological studies, which can serve as key contributions to the broader social sciences (Smith et al. 2012). While generally agreeing with Ortman (2016a), Kulisheck (2016) states that relative population estimates can still provide valuable information on culture change and cites his own work on Pueblo population dynamics (Kulisheck 2003, 2010) as examples of their usefulness.

Finally, absolute population estimates can be important when looking for evidence of large-scale migration from one region into another. Anthony (1990) outlines multiple 'push' and 'pull' structural factors linked to social networks that condition migration, such as stress in the homeland (source area) and the attractiveness of the destination (target area) communicated back to those living in the source area by scouts and later by returning migrants. A large population decrease in one area followed by an equally large population increase in another can suggest potential source and target areas for such movements (Ortman 2012, 2016a). Ortman (2012:41) calls this a "correlative approach", as it deals with changes in both magnitude and shape in both the source and target areas. Ortman (2012:41) contrasts this with the "threshold approach", which is locally oriented, meaning that it focuses entirely on population changes within one area and does not consider possible source or target area population dynamics. In the U.S. Southwest, a correlative approach has been used in assessing population dynamics and migratory patterns in the Northern San Juan (Wilshusen and Ortman 1999), Upper San Juan (Potter et al. 2012), San Juan Basin (Wilshusen and Van Dyke 2006) and Northern Rio Grande (Ortman 2012, 2016b).

3.2 Population Dynamics and the Pueblo I Period in the Northern/Upper San Juan

Previous Research. While correlative approaches using absolute population numbers have yet to be undertaken when looking at the Pueblo I period (AD 700-900) migrations in the Upper San Juan as a whole, there has been a large amount of research conducted that looks at population movement out of the San Juan drainage between AD 850 and 950 and its potential contribution to rise of Chaco Canyon in the tenth century (Schachner 2001; Varien 2010; Varien et al. 1996; Wills 2000; Wilshusen 2002, 2015; Wilshusen and Ortman 1999; Wilshusen and Wilson 1995; Wilshusen et al. 2012).

An analysis of Pueblo I archaeological sites contained within the Northern San Juan revealed that there may have been as many as 10,000 people living there by AD 860 (Wilshusen and Ortman 1999) primarily located in four distinct regions: Elk Ridge in southeastern Utah, the Mesa-Verde Dolores area in southwestern Colorado, Ridges Basin near Durango, and the Navajo Reservoir/Fruitland District in northwestern New Mexico. The consensus is that there were three main population movements between approximately AD 800 and 900, one between AD 800 and 860 into the Mesa Verde-Dolores region, another in the late AD 800s from the Mesa Verde-Dolores region into the San Juan Basin, Piedra District, and Navajo Reservoir/Fruitland District, and a third in the late AD 800s and early 900s from the Navajo Reservoir/Fruitland District into the San Juan Basin (Potter 2010a; Potter et al. 2012; Wilshusen and Ortman 1999).

Excavations at Navajo Reservoir (Eddy 1966, 1972, 1977) and Frances Mesa (Wilshusen et al. 2000) indicate the presence of Rosa Phase (AD 700-850) sites that may reflect the presence of Upper San Juan communities located in New Mexico who initially migrated from northwestern New Mexico into the Mesa Verde-Dolores region between AD 800 and 850, mixing with other Upper San Juan migrants recently arrived from the Ridges Basin community east of the La Plata River in the Durango area. The presence of glaze ware associated with Rosa Black-on-white ceramics at villages located on the east-side of the Dolores River, such as Grass Mesa and Rio Vista, and not in west-side villages, such as McPhee Village has been cited as possible evidence of these Upper San Juan migrants (Wilshusen and Ortman 1999).

In addition, architectural differences in settlement layout between west-side and east-side villages in roomblock shape and plaza definition support the presence of at least two separate ethnic groups in this area (Wilshusen and Ortman 1999; Wilshusen and Van Dyke 2006; Wilshusen et al. 2000). Finally, Webster (2009) has demonstrated the presence of twill-plaited sandals at Grass Mesa Village, which contrasts with the presence of twined sandals at McPhee Village, linking at least some migrants to the Durango area (Potter 2010a). Another view is that a percentage of Ridges Basin migrants left the Durango area between AD 800 and 850 and migrated southeast into locations such as Navajo Reservoir (Potter 2010a). Rosa Phase cultural traditions in Navajo Reservoir settlements typically included the use of glaze paint, low profile surface architecture, round pithouses, bifurcated ventilation, and informally organized, dispersed settlements (Potter et al. 2010c).

Thirty to forty years later, a significant decrease in the Mesa Verde-Dolores population occurred between AD 880 and 910 (Wilshusen and Ortman 1999; Wilshusen et al. 2000). Previous estimates of Northern San Juan population size during the late ninth century range from a minimum of 4,000 (Duff and Wilshusen 2000) to a maximum of 10,000 (Wilshusen and Ortman 1999), the majority of which were located in the Dolores-Mesa Verde region. It is believed that between 6,000 and 10,000 people left Piedra Phase (AD 850-950) communities in the Dolores-Mesa Verde region and that at least some of them migrated southeast into the Cedar Hill and Navajo Reservoir areas of New Mexico, with a smaller contingent also settling in Frances Mesa (Wilshusen and Ortman 1999). These arguments are based on the discovery of large Piedra Phase communities in Navajo Reservoir (Eddy 1966, 1972, 1974) and Cedar Hill (Wilshusen and Wilson 1995), along with scattered sites in Frances Mesa (Wilshusen et al. 2000). Additional isolated Piedra Phase sites have also been found in the same area (Ayers and Yost 1997; Hensler and Hensler 2002; Kemrer 1995).

Evidence supporting Wilshusen and Ortman's (1999) argument comes from Potter (2010a) and Potter and others (2012) in the form of tree ring data comprised of cutting and near-cutting dates for the Cedar Hill and Frances Mesa areas (henceforth known as the 'Fruitland

District' after the largest archaeological project to occur in the area), Navajo Reservoir area, Piedra District (comprising the area containing the Piedra, Los Pinos, and Upper San Juan drainages), Durango District (comprising the Animas River drainage north of the Colorado-New Mexico state line), and the La Plata District (following the La Plata River south from Colorado to Farmington, New Mexico). According to the authors, these tree ring sequences indicate two primary migration flows between the Northern and Upper San Juan areas in the ninth century: the first occurring in the early AD 800s with people moving northwest from the Durango area to the Dolores-Mesa Verde region (and perhaps even some migrating south to the Navajo Reservoir/Fruitland District); and the second occurring in the late 800s involving people moving southeast from the Durango-Mesa Verde region into the Upper San Juan (Piedra and Fruitland Districts). It seems then that the source of these Late Pueblo I communities within the Navajo Reservoir/Fruitland District may have been comprised of earlier migrants from the Durango area and ones arriving later as part of the late AD 800s Mesa Verde-Dolores exodus.

Evidence from the densest known late Pueblo I occupations located in Cedar Hill area and Navajo Reservoir strongly suggests a short occupational period for these communities. The tree ring dates tend to cluster between the AD 880s and early 900s (Potter 2010a; Potter et al. 2010b; Wilshusen and Wilson 1995) and most of the pit structures and surface architecture was burned in both locations. According to Schlanger and Wilshusen (1993), the ritual burning of structures is typically associated with the abandonment of an entire region in anticipation of long-distance moves. Finally, as we might intuitively expect, periods of substantial out-migration within the Northern San Juan resulted in decreases in source area populations responsible for such flows (Ortman 2012; Potter et al. 2010b; Potter et al. 2012; Schlanger and Wilshusen 1993; Wilshusen and Wilson 1995; Wilshusen and Ortman 1999; Wilshusen et al. 2012)

The question now is where did they go? The scholarly consensus is that Late Pueblo I communities in Cedar Hill and Navajo Reservoir migrated into the San Juan Basin near Chaco Canyon (Lakatos and Wilson 2012; Potter et al. 2012; Wilshusen 2015; Wilshusen and Van Dyke 2006; Wilshusen et al. 2000, 2012). This is based on the following lines of evidence: (1) the appearance of Red Mesa Black-on-white and neckbanded grey ware – typical indicators of very late Pueblo I to early Pueblo II communities north of the San Juan River during the late AD 800s at sites within the Chaco Basin (Wilshusen and Van Dyke 2006); (2) an increase in mid-to-late Pueblo I site density within the Chaco Basin, especially in places such as Fajada Gap, South Fork of the Fajada Wash (Wilshusen 2015), Kin Bineola and Kin Klizhin (Wilshusen and Van Dyke 2006); (3) similarities in settlement layout between the South Fork communities and late Pueblo I communities such as those at Cedar Hill (Wilshusen and Wilson 1995). Additional arguments by Wilshusen and Wilson (1995) and Wilshusen and others (2000) posit that these late ninth century Upper San Juan communities were early predecessors of Chacoan Bonito Phase great house communities due to their dispersed layout, tendency to organize around great kivas, and greater dependence on irrigation-based farming techniques.

However, it is important to point out that substantial counter arguments to the above lines of evidence exist. For example, Red Mesa Black-on-white and neckbanded gray ware has been found in locations other than Chaco, including the Northern Rio Grande (Fowles 2013; Mera 1935; McNutt 1969; Stubbs and Stallings 1953). Estimates of population increases in Chaco Canyon (Dean et al. 1994) and the Middle Rio Grande (Brown et al. 2013) do not reflect the arrival of 3000 or so immigrants from the Navajo Reservoir/Fruitland District, although estimates for the San Juan Basin (Dean et al. 1994) and Northern Rio Grande (Boyer et al. 2010) most certainly do.

In addition, architectural traits in the earliest Chacoan Great Houses included compact settlements with oversized pitstructures, similar to those seen at McPhee village rather than the dispersed settlements centered around great kivas seen east in Upper San Juan communities (Windes 2015:720). In fact, great kivas may not have been part of the original Chacoan canon at all (Sebastian 2006, Windes 2015:720). Finally, differences in settlement layout, pithouse architecture, and material culture between villages west of the La Plata River ('Northern San Juan') and those to the east ('Upper San Juan') would seem to indicate a general reluctance of Upper San Juan communities to participate in what may have been the beginnings of the Chaco Phenomenon (Simpson 2016). I will investigate these differences further as part of my assessment of material culture in Chapter 3 and incorporate these findings into my conclusion.

3.3 Population Dynamics in the Rio Grande

Previous Research. Work by Dean and others (1994), Boyer and others (2010), and Ortman (2012, 2016b), represent the most well-known published Rio Grande population estimates. However, the estimates by Dean and others (1994) are less granular than those by Boyer and others (2010) and Ortman (2012:77-80, 2016b), and do not present specific population estimates for the Tewa Basin or Taos Valley. Furthermore, Boyer and others (2010) and Ortman (2012, 2016b) use different methodologies and include slightly different areas in their own calculations. Given the above, I will reference a comparison generated by Schillaci and Lakatos (2016) that standardized population numbers for the Tewa Basin presented in Boyer and others (2010:Table 12.1) and Ortman (2012:Table 4.8, 2016b). Both Boyer and others (2010) and Ortman (2012, 2016b) believe that very few people were living in the Tewa Basin at the beginning of the tenth century (Figure 3.1).

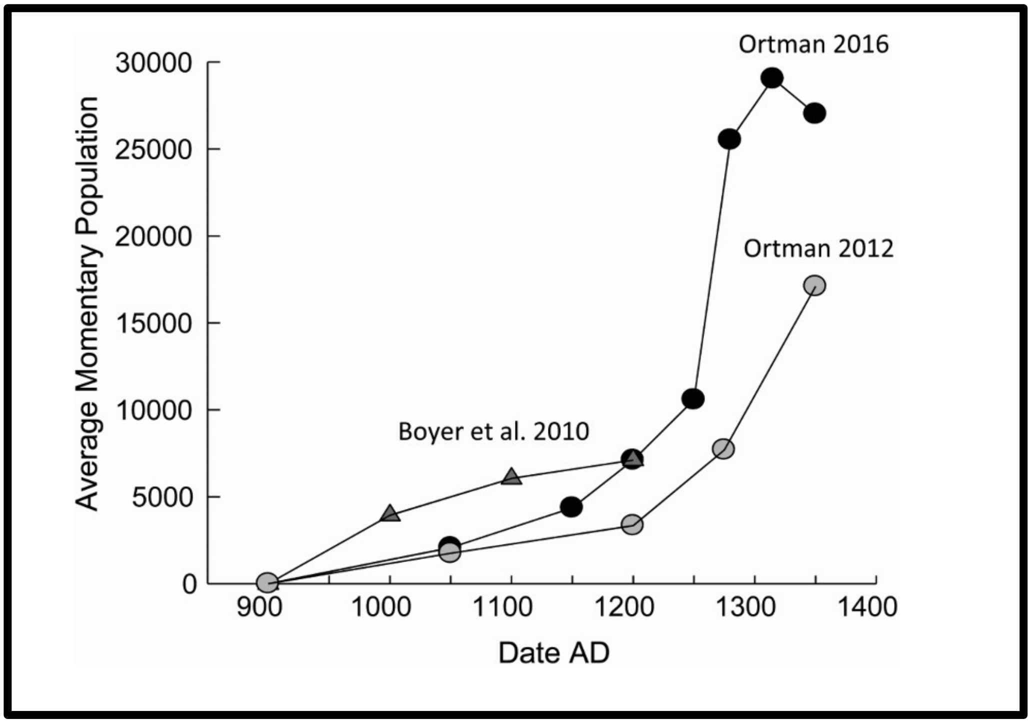

Figure 3.1 Tewa Basin Population (Schillaci and Lakatos 2016:Figure 2)

Regardless of the methodology used, all three datasets indicate that there are very few people living in the Tewa Basin at AD 900. These data indicate that main periods of population movement occurred in the tenth century and again in the thirteenth century. I decided to use Boyer and others' (2010) calculations as they included momentary population estimates for the Middle Rio Grande, whereas Ortman (2012, 2016b) did not. I will first describe how Boyer and others (2010) arrived at their population numbers before explaining how I used their results to calculate my own intrinsic growth rate and corresponding population estimates.

Boyer and Others' Methodology. To arrive at their Developmental period population estimates, Boyer and others (2010) divided the Northern Rio Grande up into three subregions based on U.S. Geological Survey 7.5 min quadrangles: the Taos Valley (TSV), the area from La Bajada Mesa to Velarde (BAJ-VEL), also known as the Tewa Basin, and the area from

Albuquerque to Cochiti (ABQ-COH) (Figure 3.2). Areas excluded from their calculations included the lower Rio Jemez, the upper Rio Pecos, the area around Picuris pueblo, the eastern part of the Sangre de Cristos, the Parajito Plateau, the Galisteo Basin, and the Rio Chama drainage. All sites were assigned to hundred-year periods based on the proportion of datable structures at each site that dated to each period. Estimates of the number of single family residential structures (pithouses) for each subregion and hundred-year period were achieved by dividing the number of recorded sites by the percent surveyed area within each subregion, assuming two contemporaneous pithouses per site.

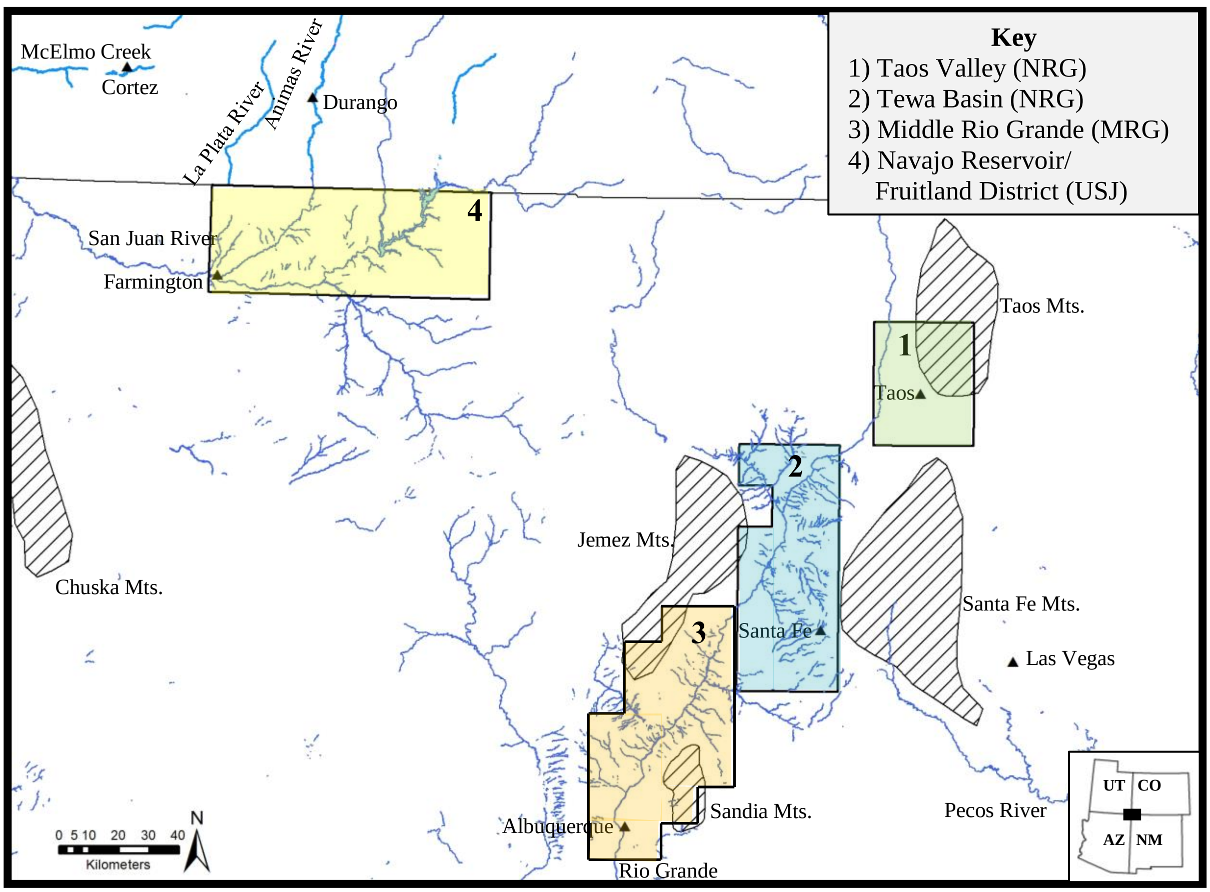

Figure 3.2 Subsections Used in Population Estimates
Note: NRG subsections adapted from Boyer et al. (2010:Figure 12.1).

Following Duff and Wilshusen (2000), Boyer and others (2010) calculated momentary household numbers by multiplying the total number of households per subregion by the ratio of pithouse use-life to period duration. Following work by Varien and others (2007) and Lightfoot (1994), Boyer and others (2010) assumed a 15-year pithouse use-life and six people per household. Finally, Boyer and others (2010) multiplied their momentary household estimates for each subregion and hundred-year interval by six to arrive at their momentary population estimates. To achieve momentary population estimates for the Coalition (AD 1200-1300) and early Classic (AD 1300-1400) periods Boyer and others (2010) calculated annual population growth rates for the previous centuries and used that to estimate population numbers for these periods.

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An important detail is that Boyer and others (2010) assume that all growth within the Northern Rio Grande is due to intrinsic growth. This assumption has been challenged by Ortman (2012:77-86) regarding the Coalition period based on his own analysis of spatial settlement patterns and age-at-death data. In their assessment of Northern Rio Grande population growth, Schillaci and Lakatos (2016) also agree that some combination of migration and intrinsic growth likely occurred during the Coalition period. While Boyer and others (2010) do not specifically state that any tenth century growth is intrinsic, they do argue that migration into the Tewa Basin during the tenth century came from within the Northern Rio Grande itself. Therefore, for the purposes of my own analysis, I will assume that their adherence to intrinsic growth rates also extends into the tenth century. However, if intrinsic growth was not the prime mover of Coalition period population growth in the Northern Rio Grande, then I believe it is possible that it was not the prime mover during the tenth century either. In the paragraphs below I discuss methods previously used (Bocquet-Appell 2002; Kohler and Reese 2014; Ortman 2012:82) to derive intrinsic growth rates from age-at-death data and their importance to the question of the origins of the initial farming population of the Northern Rio Grande.

Northern Rio Grande Population and Intrinsic Growth. Recently, paleoanthropological data has been used to study the impact of the Neolithic Demographic Transition (NDT) on agricultural populations (Bocquet-Appel 2002; Bocquet-Appel and Naji 2006) through the use of the ratio of immature skeletal remains (all individuals between five and nineteen years old) to the total number of individuals over the age of five within a population. This ratio, known as the juvenility index, or 15p5 ratio, is assumed to be high in growing populations and low in shrinking populations.

Since the 15p5 ratio is highly correlated with both the crude birth rate (0.963 R^2) and intrinsic growth rate (0.875 R^2), it can be used to derive estimates of both metrics (Bocquet-Appel 2002). Both crude birth rates and intrinsic growth rates have been important metrics in the assessment of population growth associated with agricultural communities in both Old World and New World societies (Bocquet-Appel 2002; Bocquet-Appel and Naji 2006; Kohler et al. 2008; Kohler and Reese 2014).

The importance of this for my own research is that while intrinsic growth rates have been derived using age-at-death data for the Northern San Juan (Ortman 2012; Wilshusen and Perry 2008, 2012), they have simply been assumed for the Northern Rio Grande (Boyer et al. 2010; Schillaci and Lakatos 2016). As the objective of this chapter is to assess the ability of the Northern and Southern Origin hypothesis to explain the tenth century population increase in the Northern Rio Grande, it is critical that intrinsic growth rates are data-driven and not just assumed.

3.4 Expectations

Based on the above, I have established the following expectations regarding the Southern Origin and Northern Origin hypotheses. If the Northern Origin hypothesis is correct, we should expect the following: (1) a late Pueblo I Upper San Juan a maximum momentary population between AD 800 and 900 that is large enough to provide migrants to the Northern Rio Grande; (2) a notable population decrease in period after presumed out-migration.

If the Southern Origin hypothesis is correct, we should expect the following: (1) a maximum momentary population between AD 800 and 900 in the Middle Rio Grande that is large enough to provide migrants to the Northern Rio Grande; (2) a Middle Rio Grande intrinsic growth rate close, if not equal to, the annual population growth rate seen in the Northern Rio Grande during the tenth century; (3) a significant population decrease in the Middle Rio Grande after AD 900.

3.5 Results of Data Analysis

To put my results into context, it is important to set expectations regarding lower and upper limits of intrinsic growth for preindustrial, non-urban agricultural societies. According to Cowgill (1975), the upper limit of intrinsic growth for these societies should be about 0.007, or 7 people per 1000 per year, (with a lower limit of 0.003) and previous population estimates have assumed that any growth above or below this threshold constituted immigration or emigration (Varien et al. 2007). However, under conditions of unlimited resource availability, this upper limit could expand to as high as 0.01, or 10 people per 1000 per year (Richerson et al. 2001). Additional work by Kirch (2010) on population modeling in the Hawaiian Islands has demonstrated that expansion intrinsic growth rates between 0.012 and 0.018 are achievable during exponential phases of growth.

Rio Grande. First, following Boyer and others (2010) and Schillaci and Lakatos (2016), I calculated the population growth rate for the tenth century within the Northern Rio Grande which is displayed along with Boyer and others' (2010:Figure 12.1) population numbers in Figure 3.3.

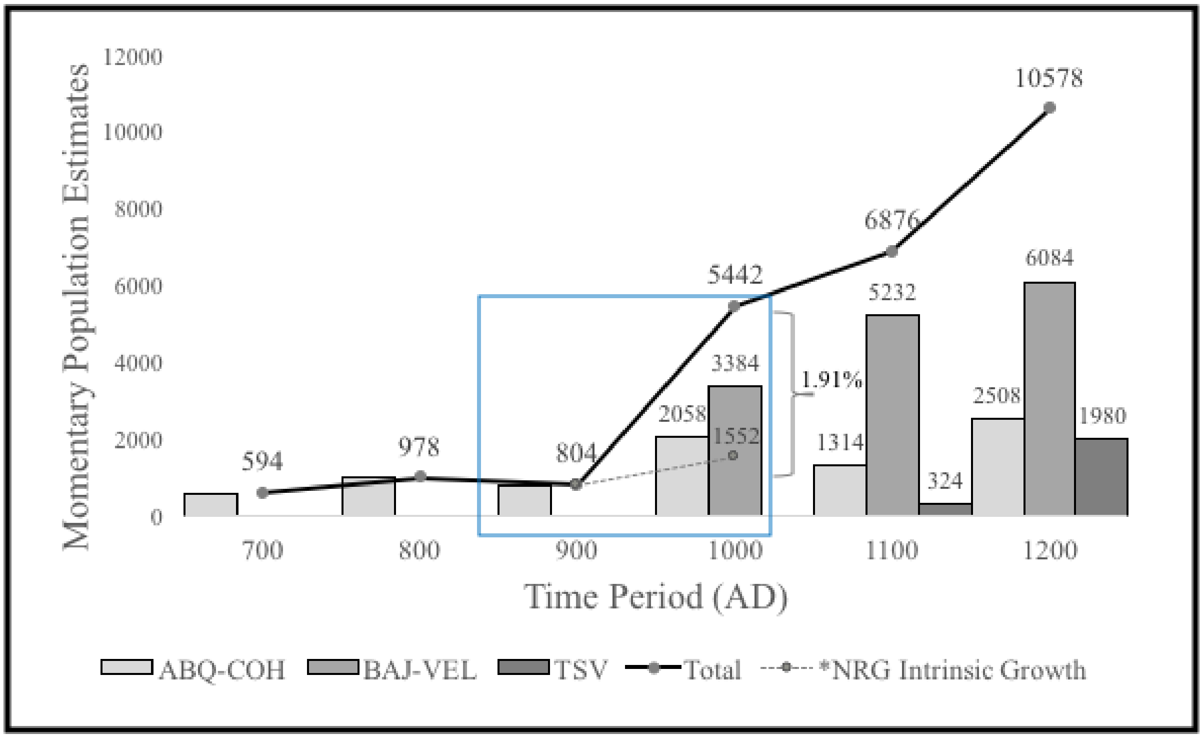

Figure 3.3 Momentary Population Estimates for the Rio Grande
Note: Data from Boyer et al. (2010:Table 12.1).
* Using intrinsic growth rate of .0066

The results of my calculations show a higher population growth rate (1.91%) than the highest rate that Kirch (2010) calculated for the Hawaiian Islands (1.8%). While this may appear unrealistic, high 15p5 ratios (and by association, high intrinsic growth rates) have been calculated for the Northern San Juan (Ortman 2012:Table 4.9; Wilshusen and Perry 2008, 2012) prior to the two periods of greatest out-migration – the Late Pueblo I and the Pueblo III periods. However, it is also important to remember that warfare tends to inflate 15p5 ratios, as it disproportionally affects young adults (Kohler et al. 2008) and should be taken into consideration when thinking about 15p5 ratios from this region and the potential impact on intrinsic growth.

Based on their own analysis, Kohler et al. (2008:659) conclude that 15p5 ratios are "at least somewhat affected by warfare-related processes in the Southwest…" Evidence for widespread warfare-related activity throughout the U.S. Southwest through time has been noted by LeBlanc (1999), Lekson (2002), Turner and Turner (1999), Kuckelman and others (2000), and Kohler and others (2014). There is also evidence for warfare-related activities at specific sites that comprise the age-at-death data from which Ortman (2012:Table 4.9) and Wilshusen and Perry (2008, 2012) derived their 15p5 ratios.

Potter and others (2010) report heavily processed human remains at the Sacred Ridge site and assert that perhaps such osteological trauma was caused by genocidal acts linked to ethnic conflict. Regarding Ortman's (2012:Table 4.9) Pueblo III data, Turner and Turner (1999:53) corroborate an earlier report's (Malville 1989) assertion of cannibalism at Yellow Jacket Pueblo (5MT3), one of the three age-at-death assemblages Ortman (2012:83) uses. Despite the effects of warfare on 15p5 ratios in the Northern San Juan, the general trends in the data suggest that the Northern San Juan had one of the highest 15p5 ratios seen in the U.S. Southwest (Kohler et al. 2008) and that elevated 15p5 ratios appear to be a prerequisite for later migrations.

I initially attempted to aggregate age-at-death data compiled by Kohler and Reese (2014) for all sites within the Middle Rio Grande dating to between AD 800 and 900 in order to minimize problems inherent in the use of small sample sizes. However, there was only one such site listed in their dataset (the Early Developmental Pena Blanca site) and that site dated earlier than my specified period. Despite these shortcomings, I decided to use these data as they were the only age-at-death data available for the Middle Rio Grande.

In lieu of sample aggregation, I chose to employ a method of Bayesian statistical inference used by Robertson (1999) in his study of Mesoamerican pottery assemblages to help ameliorate issues related to small sample sizes. Bayesian statistical inference is uniquely suited to dealing with problems associated with use of small sample sizes and related proportions and thus can be a helpful tool for archaeologists faced with such issues. Bayesian statistical inference attempts to derive an improved *posterior* estimate by incorporating *prior* beliefs into its calculation. In other words, prior knowledge about a population is used to derive better (i.e., lower associated standard errors and variance) values associated with the use of a selected sample (Robertson 1999).

To amass a sample population that could serve as my prior knowledge, I aggregated age-at-death data for all sites dating to between AD 800 and 900 within the U.S. Southwest (this included the Early Developmental Pena Blanca site). I then took the average of all the 15p5 ratios to come up with a *prior* population mean. Following Robertson (1999), I calculated constants a and b, and then used them along with age-at-death data for the lone Middle Rio Grande site to generate a *posterior* mean (Table 3.1). This *posterior* mean should be a more accurate estimate of the 15p5 ratio in the Middle Rio Grande prior to AD 900, as it incorporates information from the population at large into the revised calculation.

Applying the regression equation specified in Bocquet-Appel (2002) to a 15p5 ratio of 0.217 for the Middle Rio Grande results in an intrinsic growth rate of 0.0066, which falls within the previously specified range of 0.003 and 0.018. It also falls well short of the 1.91% (.0191) population growth rate calculated for the Northern Rio Grande on the basis of Boyer and others' (2010) settlement pattern study. To achieve 1.91% annual population growth, the Middle Rio Grande would have to have had a 15p5 ratio of 0.321. While Boyer and others (2010) argue that their population estimate for the Middle Rio Grande between AD 800 and 900 is artificially low due to the ephemeral nature of Early Developmental (AD 600-900) sites, a village within the Middle Rio Grande and/or surrounding areas large enough to generate a 15p5 ratio of 0.321 should be hard to miss. Figure 3.4 compares 15p5 ratios for the Northern San Juan and the Rio Grande between AD 600 and 1400. Relevant samples are listed in Table 3.1.

Table 3.1 15p5 Ratios in Regional Samples

Period	Samples [a]	Total (5+) [b]	Total 15p5
Rio Grande Early Developmental	SJB 850, SJB Burials, SJB Three-C Site, MRG Pena Blanca 650	163.59	0.217*
Rio Grande Late Developmental	Nambe Falls Reservoir, Pojoaque/Tesuque, NRG 1150, Taos Valley, Valdez and Talpha Phases	101.55	.259
Rio Grande Coalition	Pot Creek Pueblo, NRG 1250	62.31	.268
Rio Grande Classic	Arroyo Hondo Upper Early, Ogapogeh, Arroyo Hondo Upper Late	187	.238
Northern San Juan Pueblo I	ALP Middle, ALP Late, NSJ 850, La Plata HWY Project	274.25	.264
Northern San Juan Pueblo II	NSJ 950, Northern San Juan 1050, Ute Mountain Piedmont, Early Mesa Verde 1080	129.74	.179
Northern San Juan Pueblo III	NSJ 1150, Ute Mountain Piedmont, Late, NSJ 1250, Mesa Verde 1250	232.43	.345

Note: [a] Sample names correspond to those listed in Kohler and Reece (2014:Table S1) for all but La Plata HWY Project, which comes from Martin et al. 2001, cited in Potter et al. (2010b:Figure 16.5). Total individuals not whole numbers due to reapportioning used by Kohler and Reece (2014) following procedures in Bocquet-Appel (2002). *15p5 ratio is posterior mean after applying Bayesian methodology following Robertson (1999).

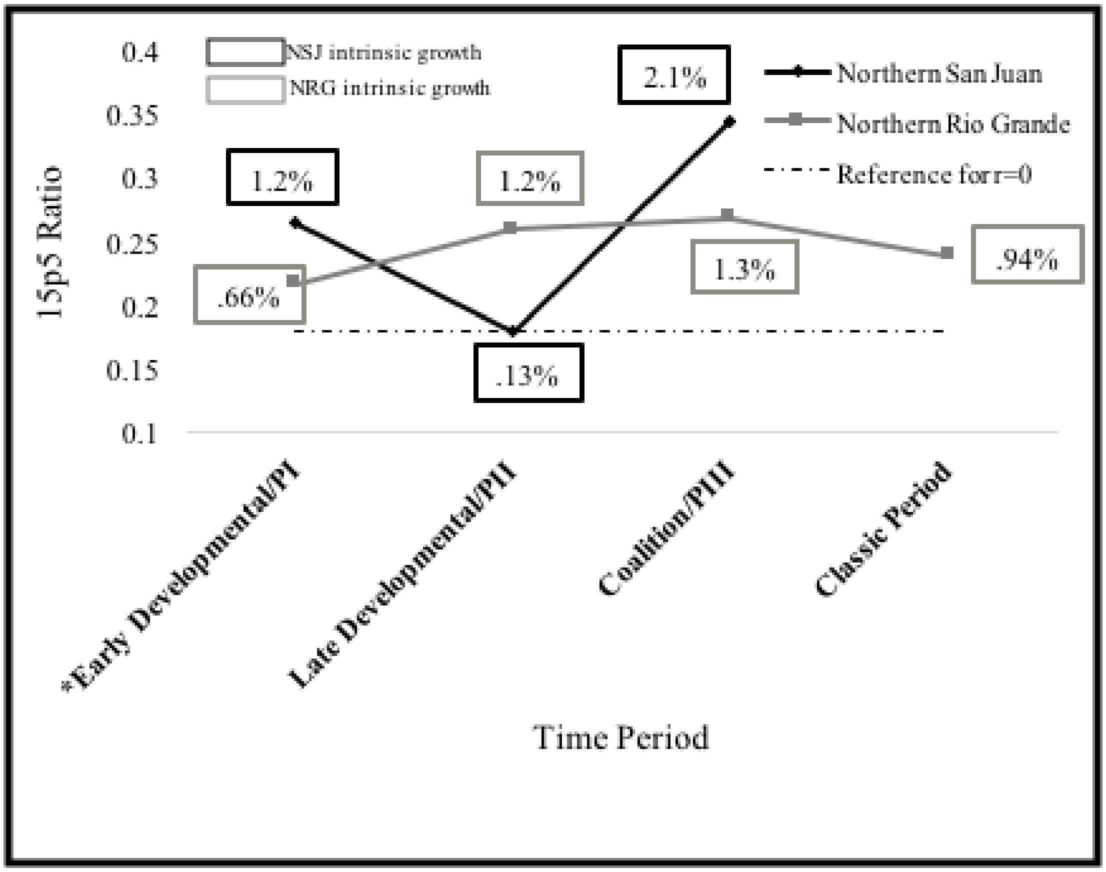

Figure 3.4 15p5 Ratios for the Northern San Juan and Northern Rio Grande
Note: An intrinsic growth rate of ‘0’ corresponds with a 15p5 ratio of .170 (Bocquet-Appel 2002).

As Northern San Juan population growth was known to be high in the Pueblo I and Pueblo III periods, one would expect intrinsic growth rates within the Northern Rio Grande to at least approach those. More specifically, we would expect to see an intrinsic growth rate much higher than 0.0066 given that Boyer and others (2010) view the Middle Rio Grande as the primary source of the tenth century population increase within the Northern Rio Grande. Furthermore, an intrinsic growth rate of .66% would only result in a maximum momentary population of 1,552 in AD 1000 (Figure 3.3), which is significantly less than the 5,442 suggested by the settlement data. While agreeing that Early Developmental sites are most likely underrepresented in current population estimates, Lakatos and Wilson (2012) suggest that as an alternative, small-scale migrations south of the Tewa Basin from Rio San Jose, Puerco of the East Valley, and Rio Grande Valley could have also played a role in the large population increase noted.

Based on this analysis, it appears that Ortman's (2012) hypothesis of external migration is the best explanation for the trends in the population data seen within the Northern Rio Grande. The question now is, were there enough people in the Upper San Juan for it to serve as a plausible source location for the arrival of around 4,000 migrants (total population at AD 1000 minus projected intrinsic growth) into the Northern Rio Grande during the tenth century?

Upper San Juan. To develop a population model for the Upper San Juan, I compiled a database of Pueblo I sites from the New Mexico Cultural Resource Information System (NMCRIS) for three block surveys conducted in an area of northern New Mexico consisting of a 3,384 km^2 piece of territory extending south from the Colorado/New Mexico border to Farmington, New Mexico, then east until the western border of the Jicarilla Apache Indian Reservation (Figure 3.5). For the remainder of this paper, I will follow Potter and others (2012) in referring to this area as the Navajo Reservoir/Fruitland District, named after the locations in which the most Pueblo I archaeological research has been conducted. The three survey blocks I selected are Cedar Hill, Frances Mesa, and La Jara Canyon.

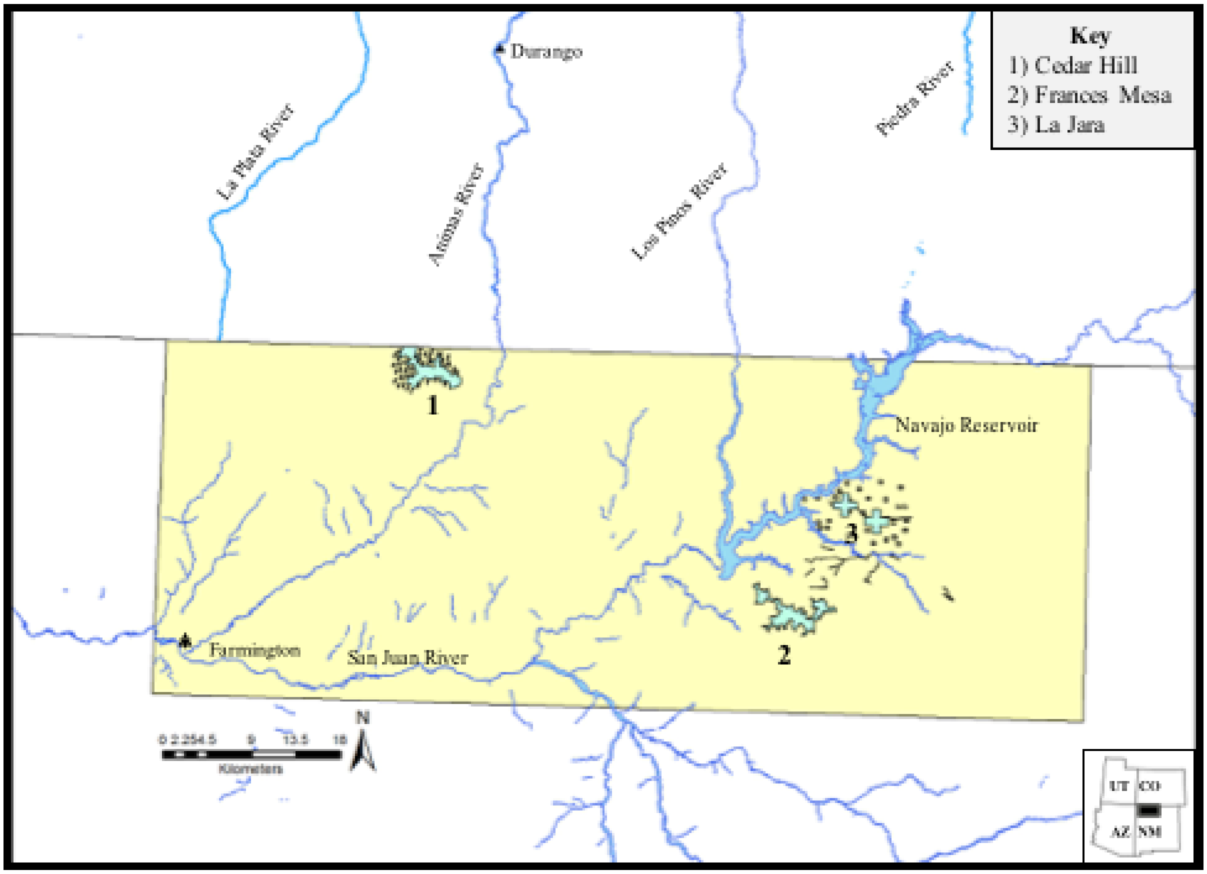

Figure 3.5 Close-Up of Study Area
Note: Adapted from Potter et al. (2012:Figure 4). Survey shapefiles courtesy of NMCRIS.

I selected these survey blocks because they comprise some of the most detailed archaeological work on Pueblo I sites within my study area (Potter et al. 2012) and include 100% survey coverage. For the purposes of my population modeling, it was critical that my selected survey blocks were completely surveyed, otherwise I would not have been able to derive the required density figures I needed. I excluded previous surveys in the Navajo Reservoir area (Dittert et al. 1961; Eddy 1966) due to a less than 100% survey coverage and questions about data quality (Wilshusen et al. 2000).

As both use-life and period duration are critical components of population estimates, it is important to ensure that assumed numbers are reasonably defined, otherwise one may end up with overly conservative results (Ortman 2012:76). First, using the NMCRIS data, I isolated all residential sites dating to the Pueblo I period within the three survey blocks. Since my goal was to derive population for Pueblo I sites, I counted single family residential structures for this period within each of the survey blocks, as these serve as the lowest order social units upon which higher level community organization is built (Lightfoot 1994).

In order to remain methodologically coherent with Boyer and others (2010), I assumed that pithouses served as the primary residences for Pueblo I households (Gilman 1987) rather than surface roomblocks (Wilshusen and Wilson 1995). Following Boyer and others (2010) and Varien and others (2007) I also assumed six people per pithouse. I based these assumptions on Lightfoot's (1994) compilation of ethnographic studies on Pueblo household size and Wilshusen and Wilson's (1995) use of similar numbers in their own population estimates of the Cedar Hill area.

I then counted the total number of pithouses associated with each site in the NMCRIS database and adjusted them using the following assumptions (Ortman et al. 2007): (1) there are at least as many pithouses as roomblocks; (2) if a site is classified as residential, you can assume the presence of at least one pithouse *if* there is a hearth and/or isolated room and/or mound and/or midden *and* no recorded pithouses or roomblocks; (3) there are at least two pithouses at sites with multiple residences; (4) there is at least one pithouse at sites categorized as single residences. Table 3.2 lists the survey blocks and associated data from this analysis.

Table 3.2 Total Pueblo I Sites and Pithouse Counts for Selected Survey Blocks

	Cedar Hill	La Jara	Frances Mesa	Total	Average number of pithouses/site	Average number of people/site
PI Sites (700 AD-900 AD)	45	9	34	88	1.75	10.50
Pithouses	93	14	47	154		

While I could have used published pithouse numbers for the Cedar Hill (Wilshusen and Wilson 1995) and Frances Mesa (Wilshusen et al. 2000) survey blocks, I did not have access to such data for the La Jara survey. Therefore, I chose to calculate the number of pithouses for all three survey blocks using the same methodology.

To validate my work, I cross-referenced my results with those published by Wilshusen and Wilson (1995) and Wilshusen and others (2000), and the results are a close match. Wilshusen and Wilson (1995) list a total of 100 pitstructures within the Cedar Hill survey area, and Wilshusen and others (2000) list a total of 44 pithouses within the Frances Mesa study area.

I calculated the momentary number of households following Duff and Wilshusen (2000) and assumed an average 15 year pithouse use-life (Cameron 1990; Gilman 1987) as utilized by Wilshusen and Wilson (1995) in their Pueblo I population estimates for the Upper San Juan and by Boyer and others (2010) in their Developmental Period population estimates. To assess period duration, I first looked at the length of the Pueblo I period based on the Pecos Classification system. According to this system, Pueblo I period duration is considered to be 200 years, beginning in AD 700 and ending in AD 900 (Kantner 2004:Figure 1.7). The Pueblo I period is further broken down into two phases: the Rosa Phase (AD 700 to 850) and the Piedra Phase (AD 850 to 950) (Sesler and Hovezak 2002).

However, studies of Rosa Phase sites within the Upper San Juan (Sesler and Hovezak 2002; Wilshusen et al. 2000) place the period of greatest occupation beginning around AD 800. Tree ring data have previously been used in the Northern San Juan as a proxy for tracking human activity on the landscape (Potter 2010a; Potter et al. 2012; Wilshusen 1999) and thus can serve as an additional line of evidence in establishing a more accurate period duration for a specified location.

While tree ring dates are not always a good proxy for estimating population size due to the re-use of wood, burning of timbers, and sample bias (Varien et al. 2007), they have been shown to be a proxy of both construction activity and population movement on the landscape (Berry and Benson 2010) in the Pueblo I period in both the Northern and Upper San Juan (Potter et al. 2010b; Potter et al. 2012).

Figure 3.6 is a histogram of 154 tree ring cutting and near cutting dates from the Navajo Reservoir/Fruitland Project District. Again, assuming that the number of tree-ring dates are correlated with the amount of human activity on the landscape and that these dates are a representative sample of tree-ring dates in the region, the distribution of these data suggests that the total period of occupation of the Navajo Reservoir/Fruitland Project District was about 100 years. These tree ring dates also support previous hypotheses (Wilshusen and Ortman 1999) suggesting two main migratory pulses into this area- one in the early AD 800s and another in the late AD 800s (Potter et al. 2012).

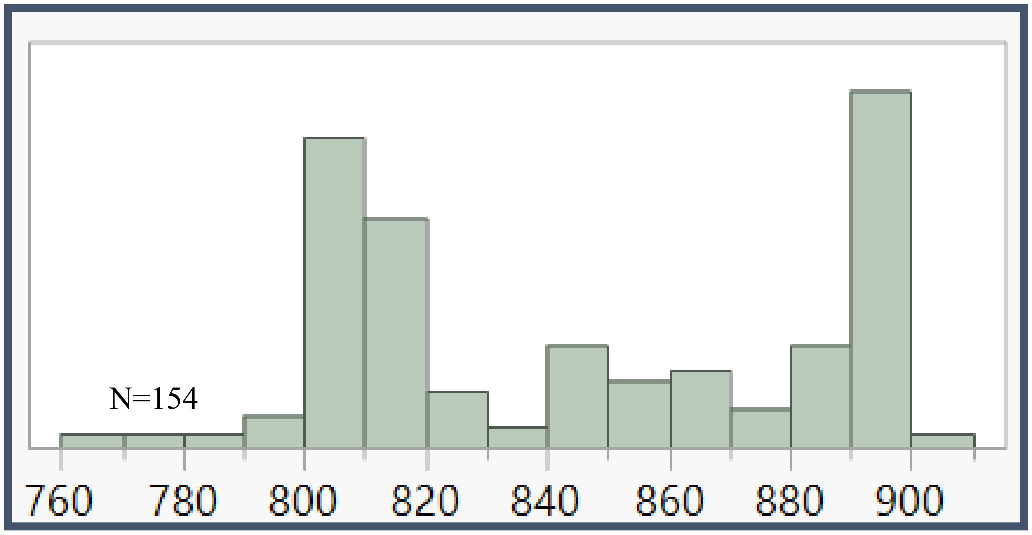

Figure 3.6 Cutting and Near Cutting Dates for the Navajo Reservoir/Fruitland District (Potter personal communication, 2017)

When extrapolating site densities from surveyed areas to a larger study area, one must adjust density figures based on some sort of limiting variable. In other words, there must be a variable, or variables, that co-vary with population density and can be used to standardize population estimates across all three survey blocks – one cannot simply assume that the entire landscape is equally suitable for habitation (Wilshusen 2002).

Using a Geographic Information System (GIS) software program called ArcGIS, I initially characterized my three survey blocks based on the following limiting variables: Elevation, Slope, Aspect, and Distance from Streams/Rivers (Table 3.3). As these survey blocks contain some of the most well-known and densest Pueblo I Upper San Juan settlements, I considered them a good sample of the type of land most suitable for habitation. Using zonal statistics, I established maximum and minimum ranges for each variable for a 30km^2 area comprising all three survey blocks. I then used a binary coincidence model to generate a raster output of the study area where each 10 x 10-meter pixel was coded as “0” (not habitable) or “1” (habitable) based on whether or not if it fell within the maximum and minimum ranges for all variables.

Table 3.3 Mean Results for Limiting Variables Used in Establishing Percent Habitable Land

Mean Results	Cedar Hill	La Jara	Frances Mesa
Elevation (m)	6,319.15	4,344.98	5,575.65
Slope (degrees)	4.64	5.28	5.00
Aspect (degrees)	152.34	177.98	180.66
Distance from streams/rivers (m)	6,319.15	4,344.98	5,575.65

From this raster layer, I calculated the percent of the entire study area deemed habitable versus not habitable (Figure 3.7; Table 3.4), subtracting the surveyed area from the total. Finally, following Duff and Wilshusen (2000), Varien and others (2007) and Wilshusen (2002), I calculated momentary population density for each survey block and the total surveyed area, and multiplied that by the total habitable area to derive maximum momentary population estimates for the entire study area.

Table 3.4 Results of Binary Coincidence Model

Value	Count	km2	Existing Survey Area (km2)	Final Habitable Land (km2)*
0	1,7605,778	1,760.57		
1	1,6237,636	1,623.76	30	1,593.02
Total	**3,3843,414**	**3,384.34**		

Note: * 1,623.76 minus existing survey area.

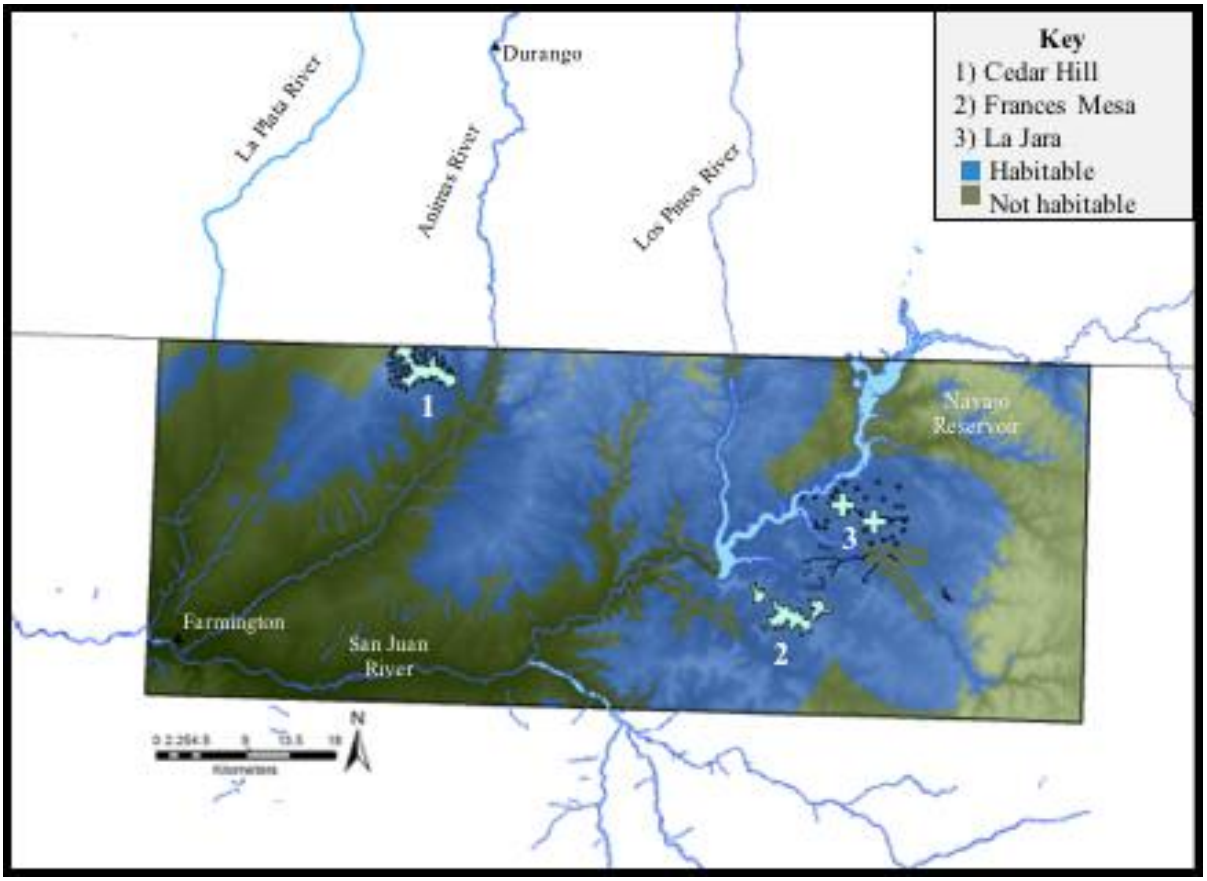

Figure 3.7 Results of Binary Coincidence Model

Momentary population estimates tell you how many people were living in a particular location at any one time. This is an important figure to consider when thinking about population estimates, as not every household was occupied at the same time over the entire occupational period (Churchill 2002). The results of my analysis (Table 3.5) indicate that a maximum momentary population of about 7,200 people were living in 1593km^2 section of the Fruitland/Navajo Reservoir District at any one time between AD 800 and 900. This is most likely too high as it assumes population density was evenly distributed across the habitable area. Using only the recorded sites from NMCRIS produces a minimum momentary population about 1,000 people. The actual population was probably somewhere in between these two extremes, perhaps around 3000. Assuming a momentary maximum population of 3000 results in a population density slightly less than that observed in the Dolores area of the Northern San Juan between AD 880 and 920, and represents around 75% of the 4,000 or so migrants who arrived in the Northern Rio Grande after AD 900.

Table 3.5 Momentary Population Calculations

	Cedar Hill	La Jara	Frances Mesa	Total
Total Area (km2)	11.29	7.69	11.76	30.74
Approximate Fraction Surveyed	100	100	100	100
Recorded PI Habitations	93	14	47	154
Recorded PI Habitations per km2	8.24	1.82	3.99	5.00
PI Total Population per km2	49.42	10.92	23.98	30.06
PI Momentary Population Estimate: Survey Blocks	7.41	1.63	3.59	4.50
PI Momentary Population Estimate: Study Area				**7,183**

Note: [a] Calculated using the following formula: (PI Population per km2*(use-life/period duration).
[b] Calculated by multiplying total PI momentary population estimate by habitable land.

It is important to keep in mind that momentary population numbers derived from site density calculations are notoriously sensitive to changes in assumptions. For example, simply assuming a more conservative use-life of 10 years rather than 15 years for pithouses, holding all other assumptions constant, generates a maximum momentary population of 4,788 people. Increasing or decreasing the period duration would have a similar effect on the result. While I believe that my assumptions are justified, it is important to emphasize the effect these assumptions have on population estimates.

In addition, a maximum momentary population number for a specific period does not account for fluctuations in population size over this period. Previous studies (Duff and Wilshusen 2000; Potter 2010a; Potter et al. 2012; Wilshusen and Wilson 1995; Wilshusen and Ortman 1999; Wilshusen et al. 2000) propose that there were two primary migrations in the Northern San Juan during the 9th century (Figure 3.8): the first from AD 800-850 when migrants left the Durango area in southwest Colorado and migrated further west (primarily to the Dolores area, but possibly to the Upper San Juan as well) and the second around AD 880 involving between 4,000 and 10,000 people from the Dolores area into the Upper San Juan (Navajo Reservoir/Fruitland District). Additional calculations by Wilshusen (2002) estimate the maximum momentary population for the Northern San Juan between AD 840 and 880 to be 8,629 people. If we assume that the number of tree ring dates is roughly indicative of migratory fluctuations, then a maximum momentary population of 3,000 within the Upper San Juan between AD 880 and 900 is not out of the question. While Grass Mesa subphase (AD 870-910) pithouse architecture from Grass Mesa village in the Mesa Verde-Dolores area is too variable to define, the majority tend to be subrectangular and measure between 6-15m^2 (Kane 1986). This suggests that if these migrants were from the Upper San Juan originally (as argued by Wilshusen and Ortman 1999), they chose to express their identity less strongly in regard to pithouse style morphology, and more strongly in terms of ceramics and settlement layout while living west of the La Plata River.

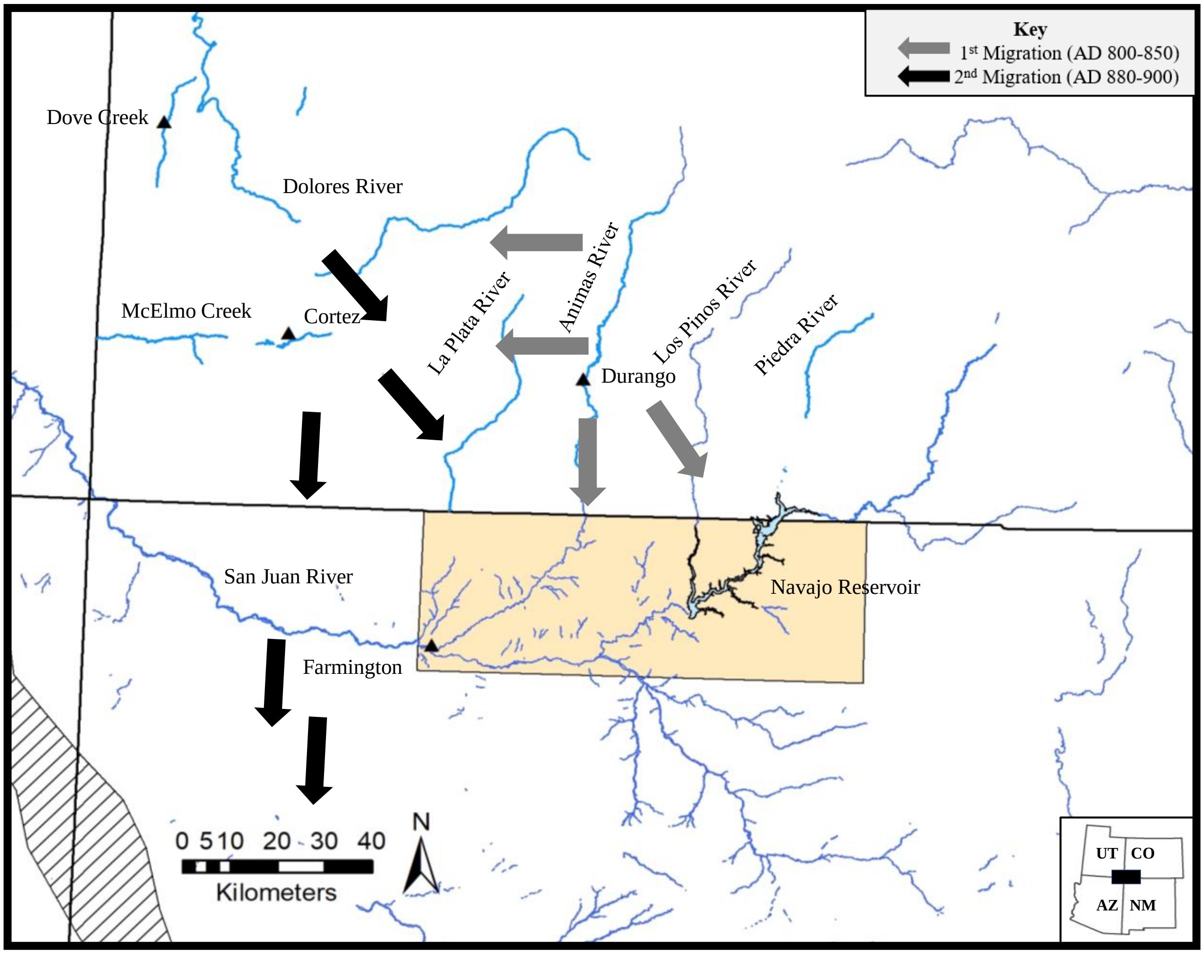

Figure 3.8 Direction of Primary Pueblo I Migrations
Note: Adapted from Wilshusen and Ortman (1999).

It is also important to emphasize that based on research by Hensler and Hensler (2002), there is a chance that sites categorized as “nonhabitation, limited use” by Wilshusen and Wilson (1995) are actually habitation sites and thus population numbers of these survey blocks may underestimate the true number of residential sites on the landscape (but see Potter 2010a). In fact, Wilshusen and others (2000:156) allude to such a problem in their assessment of Pueblo I sites in stating, “Even with the high densities of sites at Cedar Hill, Navajo Reservoir, and other

Fruitland areas, we have not yet accounted for even a small percentage of the 6,000-10,000 people who may be moving out of the Dolores, Great Sage Plain, and Mesa Verde areas".

We also need to look at population estimates for the San Juan Basin between AD 900 to 1000 to possibly rule it out as a target location for Upper San Juan immigrants leaving the area around AD 900. Population estimates for the Middle San Juan at the beginning of the Pueblo II period (AD 900-1100) hover around 250 people, and by the mid-Pueblo II period are only slightly above 500, culminating with around 800 people during the late Pueblo II period (Brown et al. 2013). This would seem to rule out the Middle San Juan as the primary target location for the late Pueblo I/early Pueblo II Upper San Juan exodus (Simpson 2016).

Although the consensus among many scholars is that late Pueblo I/early Pueblo II communities in and around Chaco Canyon were growing, in large part due to immigration (Wilshusen and Van Dyke 2006; Windes 2015), the lack of absolute momentary population numbers for both the Pueblo I and Pueblo II periods akin to those available for the Northern San Juan makes a direct comparison difficult. An analysis of existing population estimates for Chaco Canyon by Dean and others (1994) does not definitely demonstrate the type of population increase one would expect from the arrival of at least 3,000 migrants. Although they do argue for a sizable increase in population within the San Juan Basin between AD 900 and 1000 from around 40,000 people to around 58,000 people. While this seems excessive, it does highlight the complex nature of San Juan Basin population estimates. Future research focused on establishing population estimates for Chaco Canyon and additional areas such as the Chuska Mountains and Gallina-Largo area would be an important next step in improving our understanding of regional migrations.

Finally, if, as argued by Wilshusen (1999) and Wilshusen and Wilson (1995), there was a depopulation of the Navajo Reservoir/Fruitland District during the early-to-mid Pueblo II period (AD 900 to 1000), then this should be represented in the number of sites that date to this period. While the NMCRIS data does not provide enough granularity to achieve such dating precision, it does allow us to look at broad trends in site frequency. According to the database, there are 653 total residential sites that date to the Pueblo I period (AD 700-900) and 47 residential sites that date to the Pueblo II period within my predefined study area. This is a 95% decrease in site frequency, which is certainly supportive of such movement.

3.6 Assessing the Data

Ultimately, data from both the Northern Rio Grande and Northern San Juan suggest the following scenario: (1) Tree-ring cutting and near cutting dates suggest that there were two primary migrations into the Navajo Reservoir/Fruitland project District, one beginning around AD 800, and another beginning around AD 880, quite possibly from the Mesa Verde-Dolores region; (2) A maximum of 7,000 and at least 1,000 people lived in a 1593 km^2 section of the Upper San Juan at any given time between AD 800 and 900; (3) The vast majority of these late Pueblo I villages were abandoned by AD 910 as part of what is believed to be long-distance migration; (4) The population growth rate in the Northern Rio Grande between AD 900 and 1000 was greater than the highest intrinsic growth rate ever recorded for the Hawaiian Islands; (5) By AD 1000, 5,500 people were living in the Northern Rio Grande; of these, approximately 1,500 represent intrinsic growth, while the rest represent migrants; (6) Preliminary estimates for the Middle San Juan and Chaco Canyon during the late Pueblo I/early-to-mid Pueblo II period are not consistent with the arrival of several thousand migrants from the Upper San Juan.

While we would need absolute population numbers from every possible destination area to definitively say that the Northern Rio Grande was the primary destination area of the people who left the Upper San Juan at the beginning of the tenth century, the above analysis certainly *does not exclude the Northern Rio Grande* as a potential destination. While all population estimates have their drawbacks, what these data indicate is that the Upper San Juan was home to a substantial population in the ninth century. As previously mentioned, a momentary population of 3,000 would constitute around 75% of all the migrants who arrived in the Northern Rio Grande during the tenth century. In addition, the Upper San Juan contained the temporal abandonment patterns (i.e., deliberate burning of residential structures) consistent with a late Pueblo I/early Pueblo II long-distance migration (but see Eddy 1972, 1974).

In contrast, the current data suggests that the Middle Rio Grande: (1) did not have a large enough population to serve as the primary driver of the tenth century Northern Rio Grande population increase; (2) had an intrinsic growth rate that was not high enough to generate the annual growth seen in the Northern Rio Grande; (3) contains no evidence of a decrease in population numbers indicative of a large exodus of people into the Northern Rio Grande. Ultimately, these data suggest that the Southern Origin hypothesis is not the most compelling explanation for evidence related to population dynamics and that the Northern Origin hypothesis presents a more compelling explanation for the current data.

CHAPTER 4

MATERIAL CULTURE

4.1 Previous Research: Northern and Upper San Juan

Scholars consider the Northern San Juan to be culturally distinguishable from the Upper San Juan based primarily on differences in ceramic traditions, settlement layout and pithouse architecture (Wilshusen 1999; Chuipka 2008; Chuipka and Hovezak 2008). The three main Pueblo I red and white ceramic types in the San Juan drainage overall are Bluff Black-on-red (southeastern Utah), Piedra Black-on-white (southwestern CO), and Rosa Black-on-white (southeastern CO/northwestern NM) (Wilshusen and Ortman 1999). Given the ubiquity of plain gray utility ware in Pueblo I assemblages, these three ceramic types represent primary temporal and locational markers (Wilshusen 1999) and possibly ethnic markers as well (Wilshusen 1999; Wilshusen and Ortman 1999; Ortman 2012).

However, there is a significant amount of variability in the distribution (and sometimes identification) of these ceramic traditions across the Northern and Upper San Juan, with both Piedra and Rosa ceramics, or variations thereof (e.g., Chapin Black-on-white, Cortez Black-on-white, Bancos Black-on-white, Mancos Black-on-white) being produced in both locations at different times during the Pueblo I period (Dittert et al. 1961; Kemrer 1995; Wilshusen and Wilson 1995; Wilshusen and Ortman 1999; Wilshusen et al. 2000; Sesler and Hovezak 2002; Potter et al. 2010a; Wilshusen et al. 2012). Figure 4.1 illustrates the approximate locations of the main San Juan decorated pottery types circa AD 840.

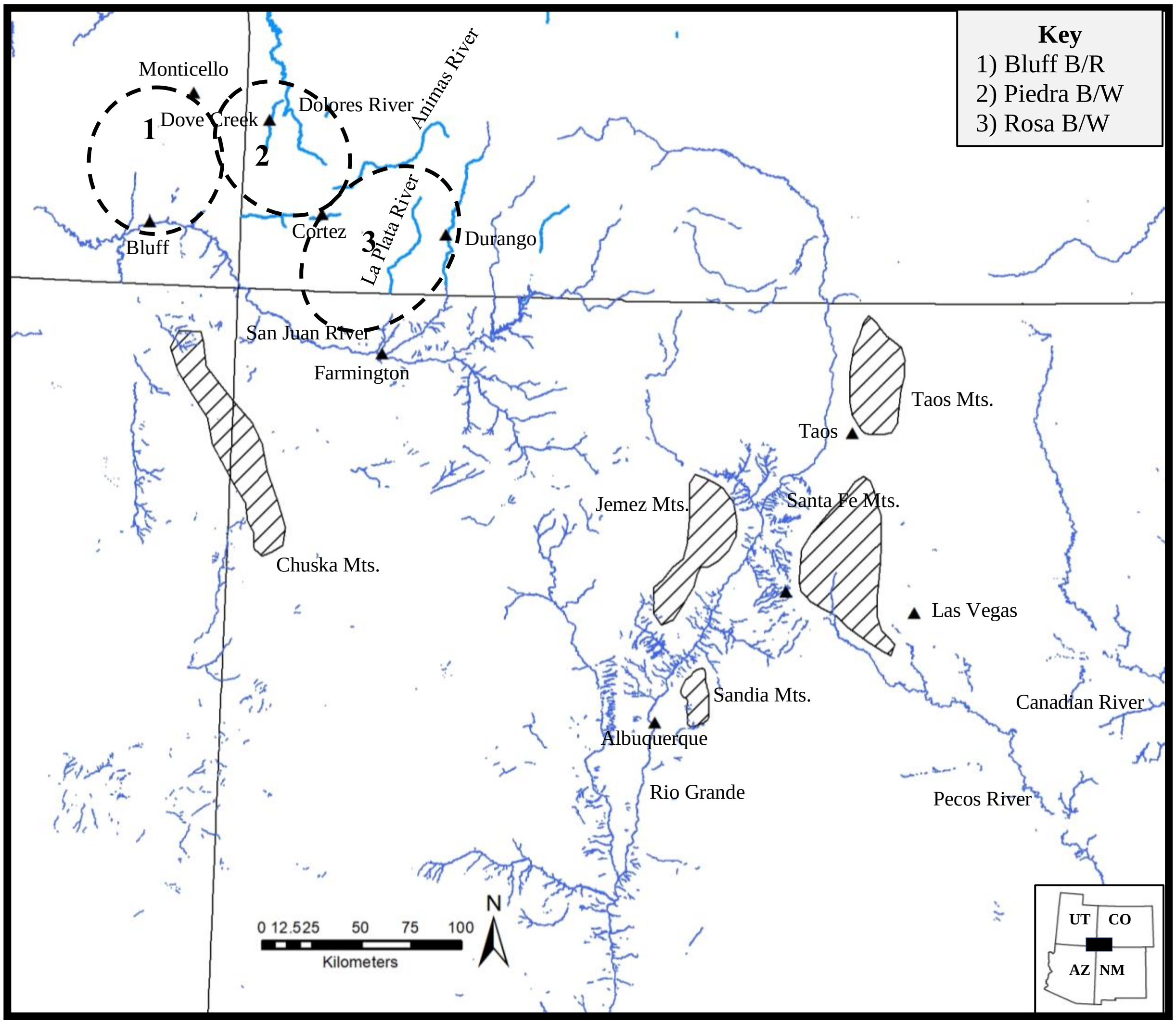

Figure 4.1 Distribution of Main San Juan Decorated Types
Note: Adapted from Wilshusen and Ortman (1999:Figure 6).

For example, in the Mesa Verde region, the Piedra phase is considered to run from AD 750 to 900, while in the Navajo Reservoir/Fruitland District, it is considered to run from AD 850 to 950 based on tree-ring dating. This is due to the dating associated with the production of Piedra Black-on-white, with production beginning in the Dolores area in southwest Colorado as early as AD 765, but not in the Upper San Juan area of northwest New Mexico until the mid-AD 800s at the earliest (Wilshusen 1999).

4.2 Previous Research: Rio Grande.

In the Rio Grande, archaeologists have used the absence of 'site-unit intrusions' as evidence of cultural continuity and against large-scale migration into the Northern Rio Grande during the Developmental period (Boyer et al. 2010; Lakatos 2006, 2007; Lakatos and Wilson 2012; Schillaci and Lakatos 2016, 2017; Ware 2016). All the studies advocating for cultural continuity within the Rio Grande have done so as a counterpoint to Ortman's (2012) argument for a thirteenth century population movement of migrants from the Mesa Verde region into the Northern Rio Grande. Only Ware (2016) briefly mentions how a similar argument could be made against Ortman's (2012:418-419) assertion of a tenth century migration of Proto-Tiwa speakers into the Tewa Basin.

Arguments for cultural continuity rely primarily on four main lines of evidence: (1) pithouse architecture; (2) ceramics; (3) indigenous place names; (4) population dynamics. Southern Origin proponents have argued that continuity in key pithouse traits such as detached above floor vent tunnels coupled with a 'core' feature complex consisting of adobe-collared hearths, ash pits, deflectors, and ventilators all indicate continuity of occupation between the Early and Late Developmental periods (Lakatos 2006, 2007; Lakatos and Wilson 2012; Schillaci and Lakatos 2017). Southern Origin proponents also believe that the Rio Grande ceramic series beginning with Kwahe'e Black-on-white is evidence of a coherent, wholly indigenous ceramic progression (Mera 1935; Schillaci and Lakatos 2017; Stubbs and Stallings 1953; Wilson 2013). Arguments have also been made for robust enough intrinsic growth to substantially contribute to the population increases seen during the Late Developmental period (Boyer et al. 2010; Schillaci and Lakatos 2016). Finally, some scholars have also presented evidence that the earliest names for Northern Rio Grande archaeological sites were Tewa and not Tiwa names (Schillaci et al. 2017).

4.3 Pithouse Architecture

Northern and Upper San Juan. Differences in pithouse architecture for the Pueblo I period have traditionally been broken down by region (west versus east) and ceramic tradition (Piedra versus Rosa) and vary through space and time. While not a hard and fast rule, Pueblo I sites located to the west of the La Plata River typically look more like each other than sites located to the east of the La Plata River (Chuipka 2008). For the purposes of my own analysis, I will summarize pithouse characteristics of both the eastern and western regions for villages dating to between AD 840 and 910. This period roughly corresponds to the periods of greatest migration both into and out of the Northern San Juan and Upper San Juan (Wilshusen and Wilson 1995; Wilshusen 1999; Wilshusen and Ortman 1999; Potter et al. 2012; Wilshusen et al. 2012) and contains relatively limited intra-regional variability such that general trends can be established (Kane 1986). Given the sheer variety of pithouse traits, I will only list those deemed the most diagnostic for the purposes of regional comparisons.

Sites in the western area typically contain high frequencies of square to subrectangular pithouses with four main support posts, wing walls, and deflectors, while lacking adobe milling bins. Ventilators frequently consist of a vertical shaft and horizontal tunnel with a single-hole in the structure. Ventilation tunnels and pithouses have more southerly orientations, mirroring the general north-south orientation of settlement layouts. Sites in the eastern area, in contrast, typically contained higher frequencies of circular pithouses with two-hole (bifurcated) ventilators, molded adobe milling bins, partial benches, and lacking wing walls (Kane 1986; Hovezak and Sesler 2002a; Potter and Yoder 2008; Potter et al. 2010c).

The distribution of pithouse traits generally followed a west-east trend; however, both the western and eastern regions contained communities with mixed traits (Chuipka and Hovezak 2008; Potter 2010b, 2010c). In the west, scholars have noted distinct differences in settlement layout and ceramic assemblages between villages on the eastern side of the Dolores River (Grass Mesa, Rio Vista, House Creek, and May Canyon) and the western side of the river (Windy Ruin, Cline Crest, 5MT10-12, and McPhee Village) that may indicate the presence of migrants from the Upper San Juan on the eastern side (Wilshusen 1999; Wilshusen and Ortman 1999). In the east in the Ridges Basin valley, just south of Durango, Colorado, there was significant variation in both pithouse architecture and settlement layout that some (Potter et al. 2010c) have argued go beyond simple trait admixture as previously advocated by others (Hovezak and Sesler 2002b). Instead, the unique mixture of trait and settlement patterning is considered to be evidence of a multiethnic community that is actively using material culture as a form of power negotiation.

It is important to distinguish the difference between Rosa and Piedra ceramic traditions as defined above vs. Rosa (AD 750-850) and Piedra (AD 850-950) pithouse architecture as described within the Navajo Reservoir/Fruitland District. Rosa phase pithouses within the Navajo Reservoir/Fruitland District can generally be considered akin to Eddy’s (1966) ‘plain’ style (Hovezak and Sesler 2002b), characterized by floor spaces between 10 and 70 square meters combined with a lack of benches, ash pits, warming pits, partition walls (wing walls), deflectors, and subfloor pits (Eddy 1966:363). However, variation among Rosa phase pithouses does exist, as evidenced by Hall's (1944) site 12 (LA 2122), which contains descriptions of pithouses containing wing walls and deflectors (Hovezak and Sesler 2002b).

Piedra phase pithouses, or Eddy's 'Elaborate' style pithouses, generally range in floor area from 20 to 81 square meters and contain benches, ventilators, hearths, partition walls (wing walls), ashpits, warming pits, and deflectors (Eddy 1966; Hovezak and Sesler 2002b). Despite their name, Piedra phase pithouses within this study area can be considered more architecturally similar to pithouses from the eastern region (Potter 2010b). Piedra phase pithouses of the Rosa ceramic tradition are generally circular with partial benches, molded adobe milling bins, and bifurcated vent tunnels and lack wing walls and deflectors (Hovezak and Sesler 2002a; Potter 2010b).

It is important to consider the connection between pithouse morphology and cultural identity, as the expression of cultural traits has the potential to speak to the presence of different ethnic groups within a single community or across a region (Sesler and Hovezak 2002). Specifically, within the Northern San Juan, differences in ceramic styles and community architecture have been associated with differences in ethnic and linguistic diversity (Chuipka 2008; Sesler and Hovezak 2002; Ortman 2012; Wilshusen and Ortman 1999). Pithouses were not only the primary center of domestic activity, as evidenced by their association with domestic artifacts and features, but they were also imbued with cosmological significance. Commonalities in the location of grinding stations, the frequency of sipapus and patterns in ventilator orientation have all been cited as domestic manifestations of specific worldviews (Fowles 2013:96-97).

Rio Grande. The linchpin of many arguments for cultural continuity is Lakatos' (2006, 2007) diachronic comparisons of Developmental period pithouse architecture and what he calls "San Juan Anasazi" (Lakatos 2006:12) Pueblo I-III (AD 700-1300) pithouse architecture. It is important to note the difference between Lakatos' terminology and my own before addressing the subregional comparisons. The region Lakatos (2006) refers to as the 'Upper San Juan' actually includes areas I have defined as the Northern San Juan and Upper San Juan (Figure 4.1). While Lakatos (2006:54) defines his Upper San Juan designation as including "…the northern tributaries of the San Juan River and San Juan Basin (SJB), which includes the southern tributaries" (Figure 4.2). However, scholars who work in the region define the northern tributaries of the San Juan river as the Northern San Juan, not the Upper San Juan (Chuipka and Hovezak 2008; Simpson 2016; Wilshusen 1999) and I have chosen to follow their lead. Furthermore, in looking at the locations of Lakatos' 11 sites and 21 structures (Lakatos 2006:Appendix B and C) associated with what he calls Upper San Juan, I noticed that only one (LA4169) is actually located in what many scholars consider to be the Upper San Juan. Of the remaining, five are in San Juan County in southeast Utah and five are in Montezuma County in southwest Colorado (Table 4.1; Figure 4.3). In addition, of the 10 sites that come from the Northern San Juan, the overwhelming majority (80%) post-date the Pueblo I period. The only two that date to the Pueblo I period are McPhee Village (5MT4475) and Pueblo de las Golondrinas (5MT5108). Thus, the only site in Lakatos' (2006) data that is both located in the Upper San Juan and dates to the Pueblo I period is LA4169.

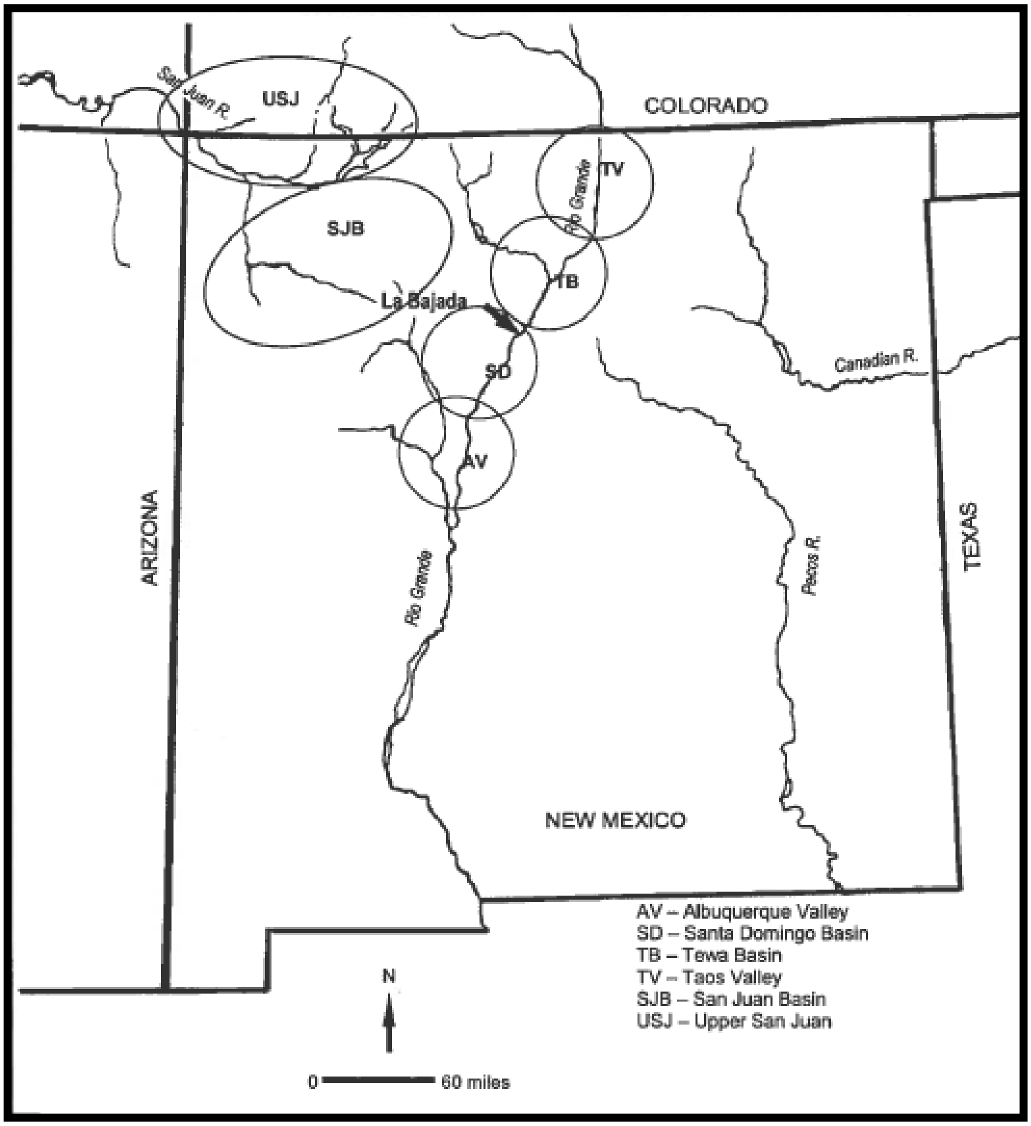

Figure 4.2 Subregions as Referenced by Lakatos (2006:Figure 15)

Table 4.1 Sites and Number of Structures Used in Study

					Time Period						
State	**County**	**Subregion**	**Site Number**	**# of Pithouses**	**600-700**	**700-800**	**800-900**	**900-1000**	**1000-1100**	**1100-1200**	**Source**
Lakatos' (2006) Sample (AD 800-1000)											
NM	Rio Arriba	USJ	LA4169	1	X						Eddy 1966
CO	Montezuma	NSJ	MV499	2						X	Lister 1964
CO	Montezuma	NSJ	MV866	3					X	X	Lister 1966
CO	Montezuma	NSJ	MV875	2						X	Lister 1965
CO	Montezuma	NSJ	5MT4475	5			X	X			Brisbin et al. 1988
CO	Montezuma	NSJ	5MT5108	2			X				Kuckelman 1988
UT	San Juan	NSJ	Brew1	1						X	Brew 1946
UT	San Juan	NSJ	Brew7	1						X	
UT	San Juan	NSJ	Brew9	1						X	
UT	San Juan	NSJ	Brew11	1						X	
UT	San Juan	NSJ	Brew13	2						X	
			Total	**21**							
Upper San Juan Sample (AD 800-900)											
NM	Rio Arriba	USJ	LA4086	1			X				Eddy 1966
NM	Rio Arriba	USJ	LA4131	1			X				
NM	Rio Arriba	USJ	LA4195	8			X				
NM	Rio Arriba	USJ	LA4380	4			X				
NM	Rio Arriba	USJ	LA55185	2			X				Kemrer 1995
NM	Rio Arriba	USJ	LA66705	1			X				Kleidon and Till 2004
NM	Rio Arriba	USJ	LA72968	1			X				Hensler and Hensler 2002
NM	San Juan	USJ	LA78524	1			X				
NM	San Juan	USJ	LA78533	1			X				Sesler 2002
NM	Rio Arriba	USJ	LA78861	2			X				Yost 1997
NM	San Juan	USJ	LA82977	1			X	X			Hovezak 2002
			Total	**23**							

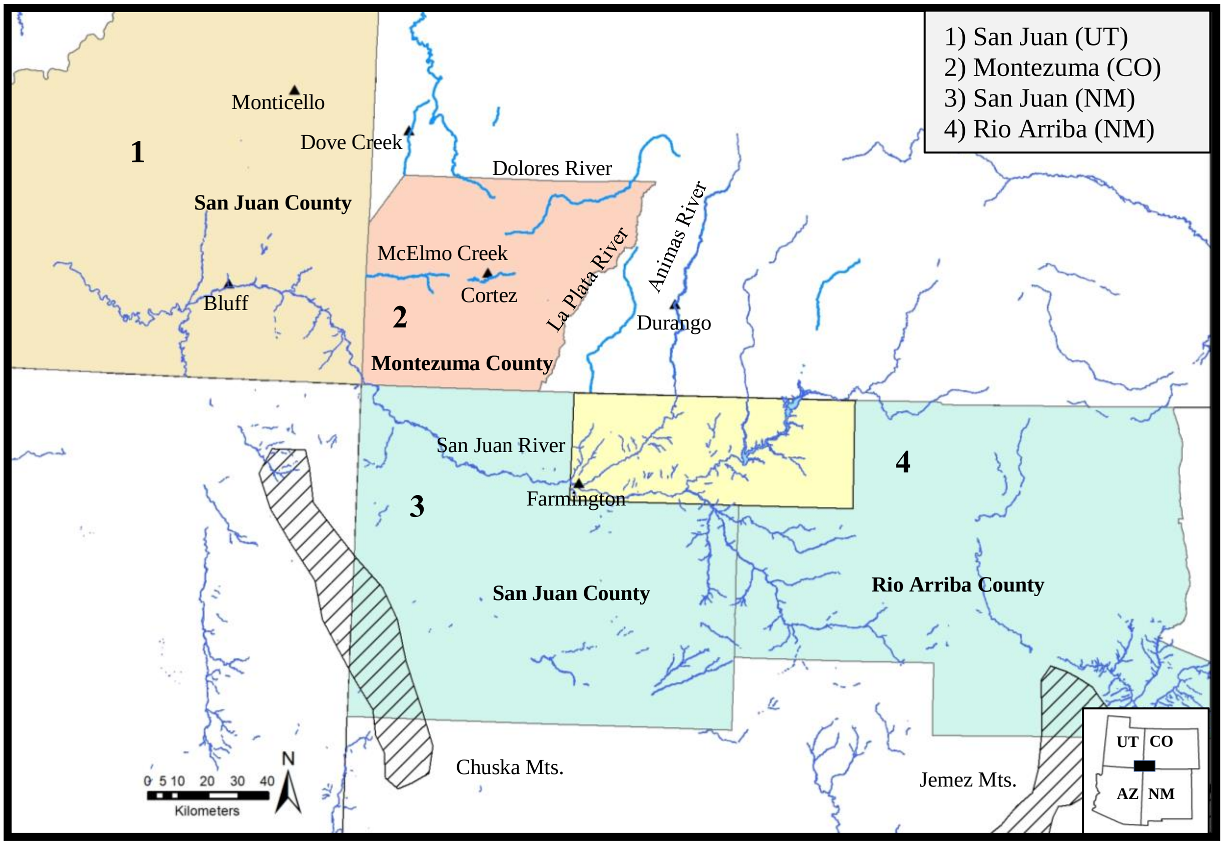

Figure 4.3 Counties Referenced in This Study

Although aggregating samples for the purposes of obtaining statistically meaningful comparisons is certainly useful, one of the downsides is that it can obfuscate important variation within the dataset. In the context of Pueblo I migration, aggregating the data in such a way masks important spatial and cultural variation between the Northern San Juan and Upper San Juan. Furthermore, Lakatos' (2006) use of the term 'Upper San Juan' to describe what are essentially two different subregions is confusing and a bit misleading, as his data actually comes from what many scholars refer to as the Northern San Juan and the San Juan Basin. The key takeaway is that while Lakatos (2006) provides a compelling argument that pithouse architecture in the Northern San Juan and San Juan Basin differ from that in the Northern Rio Grande, his work does not address similarities and differences between Pueblo I Upper San Juan pithouse architecture and Developmental pithouse architecture in the Northern Rio Grande.

Lakatos' Analysis. As part of his thesis, Lakatos (2006) performed an interregional comparison of both pithouse design and construction methods across 300-year time periods beginning in the early Developmental/Pueblo I period (AD 600-900) and ending in the Coalition /Pueblo III period (AD 1200-1300). In his analysis, Lakatos (2006) looked at the following pithouse characteristics: (1) structure shape; (2) structure containment; (3) roof support type and number; (4) presence/absence of a central hearth, ash pit, and sipapu; (5) ventilator shaft location and style; (6) deflector type; (7) enclosed space; (8) structure orientation.

Lakatos (2006, 2007) concluded that Developmental (AD 600-1200) pithouses tended to include circular, adobe-collared hearths, ashpits, deflectors and above-floor protruding sill ventilator openings, and tended not to include wing walls, benches, and antechambers (all traits that are common in San Juan pithouses). In addition, Developmental pithouses generally were more easterly oriented and Lakatos' 'San Juan Anasazi' pithouses were more southerly oriented. A later publication by Lakatos and Wilson (2012:134) updated and confirmed these findings. The authors state that:

> "The basic architectural footprint of an early Developmental residential pit structure consisted of a round, moderately deep (0.5-1.5m) pit structure with a separate or detached ventilator shaft oriented to the east or southeast and connected to the interior of the structure by an above-floor vent tunnel. Most had a central thermal feature bordered by an adobe collar. Structures typically had less than $29m^2$ of enclosed space. Through time, the presence of an ash pit fluctuated, but the occurrence of a ventilator increased. Wall niches, sipapus, and dampers were uncommon in structures throughout the early Developmental period".

Lakatos (2006) mentions that his sample of archaeological sites and associated structures come from the Upper San Juan, San Juan Basin, Taos Valley, Tewa Basin, Santa Domingo Basin and Albuquerque Valley subregions (Figure 4.2). He later aggregates the number of pithouses from the Upper San Juan and San Juan Basin into a larger group called 'San Juan' for purposes of his diachronic comparison with the Northern Rio Grande. Table 4.2 lists all the San Juan sites, associated structures, and corresponding periods that Lakatos (2006) uses in his analysis. What we see is that 30% (n=21) of the structures located in the San Juan region come from the Upper San Juan, while 70% (n=48) of them come from the San Juan Basin.

Table 4.2 Number of Structures by Region, Subregion, and Time Interval

		Time Period (AD)						
Region	**Subregion**	**600-700**	**700-800**	**800-900**	**900-1000**	**1000-1100**	**1100-1200**	**Table Total**
San Juan	Upper San Juan	1	1	4	3	1	11	**21**
	San Juan Basin	19	16	2	4	7	0	**48**
	Group Total	**20**	**17**	**6**	**7**	**8**	**11**	**69**
Rio Grande	Albuquerque Valley	10	7	11	11	0	1	**40**
	Santo Domingo Basin	1	11	4	4	6	5	**31**
	Tewa Basin	0	0	0	2	13	13	**28**
	Taos Valley	0	0	0	0	0	32	**32**
	Group Total	**11**	**18**	**15**	**17**	**19**	**51**	**131**
Table Total		**31**	**35**	**21**	**24**	**27**	**62**	**200**

Note: Data from Lakatos (2006:Table 1).

4.4 Expectations

I have established the following expectations regarding the Southern Origin and Northern Origin hypotheses. If the Northern Origin hypothesis is correct, we should expect to see continuity in many aspects of material culture between what I consider to be the Upper San Juan and the Northern Rio Grande. While there are no explicit a priori expectations regarding how material culture should or should not manifest within the archaeological record, continuity between the Upper San Juan and Northern Rio Grande would support the inference of migration, even if the absence of continuity would not necessarily contradict it. If the Southern Origin hypothesis is correct, we should expect the following: continuity in many aspects of material culture between the Middle Rio Grande and Northern Rio Grande, and discontinuity in material culture between the Upper San Juan and Northern Rio Grande.

4.5 Results of Data Analysis: Pithouse Attributes

To address the gap in the literature regarding comparisons between Pueblo I Upper San Juan and Developmental Period Northern Rio Grande pithouse architecture, I compared my own sample of Pueblo I Upper San Juan pithouses with a subset of Lakatos' (2006) Developmental period pithouses dating between AD 800 and 1000 to assess the level of similarity or dissimilarity between the Upper San Juan and the Northern Rio Grande using a variety of metrics. I chose to extend the period of analysis of Rio Grande pithouses into the first part of the tenth century to maximize available sample sizes for the purposes of statistical comparisons with data from the Upper San Juan as well as to include the few pithouse structures from the Tewa Basin included in Lakatos' (2006) analysis.

Following Lakatos (2006), I compiled a list of 23 excavated Upper San Juan pithouses dating from the mid-to-late Pueblo I period (AD 800-900) or the very early Pueblo II period (AD 900-920). Pithouses considered primarily ritualistic and/or communal rather than domestic were excluded from the analysis. Ritualistic and/or communal pithouses in the Northern San Juan/Upper San Juan have previously been called Shabik'eschee kivas (Eddy 1966), great kivas or oversized pitstructures (Wilshusen et al. 2012) and generally have total floor space of at least 50 meters squared in combination with a lack of ash pits, sipapus, subfloor pits, adobe rimmed hearths, partition walls, deflectors or warming pits (Eddy 1966; Wilshusen et al. 2012). I then selected pithouse architectural traits deemed the most characteristic of Developmental pitstructures between AD 800 and 1000, as indicated in Lakatos (2006, 2007) and Lakatos and Wilson (2012), and compared Lakatos' (2006, 2007) attribute frequencies for pithouses dating between AD 800 and 1000 from both the Northern Rio Grande and Northern San Juan with my own pithouse attribute frequencies from the Upper San Juan (Table 4.2).

While I attempted to emulate Lakatos' (2006, 2007) methodology wherever possible to facilitate a coherent comparison between regions, this was not always feasible due to variability in site report content. Therefore, I also summarized the data following Lakatos and Wilson (2012) for ease of statistical comparison. Table 4.3 lists the selected characteristics along with corresponding frequencies and percentages for all three samples. The colored cells indicate statistically significant differences in attribute frequency between subregions at the 95% confidence interval, with green indicating traits that are more frequent than in the Northern Rio Grande, and red indicating traits that are less frequent. The original charts and statistical results from my own work can be found in the Appendix.

Table 4.3 Comparison of Pithouse Architectural Traits

Structure attribute	Northern Rio Grande	Upper San Juan	'San Juan'*
Room shape (round)	20 (62.5%)	22 (95.7%)	4 (30.8%) [7]
Structure containment (all earth) [1]	24 (75%)	22 (95.7%)	8 (61.5%)
Four Primary Roof posts [2]	25 (78.1%)	16 (69.6%)	5 (38.5%)
Separate Vent Shaft	26 (81.2%)	18 (78.2%)	10 (76.9%)
Above-floor vent opening	19 (59.3%)	11 (47.8%)	1 (7.7%)
No Deflector [3]	17 (53.1%)	14 (60.9%)	4 (30.8%)
Circular hearth	17 (54.8%)	21 (95.5%)	7 (53.8%)
Hearth collar [4]	21 (65.6%)	16 (69.5%)	1 (7.7%)
Ash pit	23 (71.9%)	10 (43.5%)	8 (61.5%)
No Sipapu	20 (62.5%)	15 (65.2%)	3 (23.1%)
No Wall Niches[5]	13 (72.2%)	11 (47.8%)	N/A [8]
Enclosed space (less than or equal to 28.5m2) [6]	14 (77.8%)	2 (13.3%)	N/A [8]
Mean Orientation	116.2	116.6	168.9 [9]
Sample Size	*N=32*	*N=23*	*N=13*

Note: Cells contain counts (%) of pithouses with the given attribute. Shading indicates statistically-significant differences with the Rio Grande at the P<.05 level (Green = more, Red = less). [1]Unless otherwise specified, all earth containment assumed. [2]Four Post category selected as it was the most frequent Developmental roof support category in Lakatos (2006). [3]Deflector used as a single category due to wide variety in deflector styles across regions combined with low sample sizes. [4]As Eddy (1966) did not include data on whether or not adobe lined hearths had adobe collars in his tables, I assumed that they did based on Eddy's (1966:354) comments regarding the correlation of adobe lined hearths and adobe collars. [5]Developmental data from Lakatos and Wilson (2012:Table 7.1), base size=18. [6]Data from Lakatos and Wilson (2012:Table 7.1), mean plus one standard deviation, base size=18. [7]Statistical significance only marginally rejected with p value of .051. [8] Frequency data not available for NRG in Lakatos (2006). [9]Only means provided in Lakatos (2006) thus conditions not met for statistical testing; NRG and SJ data derived from weighted average of means listed in Lakatos (2006:Table 25). * This is the region Lakatos (2006) refers to as the 'San Juan', however it really refers to what many scholars believe to be the Northern San Juan and San Juan Basin. This 'San Juan' sample consists of all pithouses dating to between AD 800 and 1000 from Lakatos' (2006) data.

Assessing the Data: Pithouse Attributes. The results of my analysis demonstrate that Upper San Juan and Northern Rio Grande pithouses have the same pattern of attributes for seven of the twelve attribute categories. Pithouse orientation, while not statistically analyzed, also follows a similar directional trend between regions. If we turn our attention to the categories where we can reject the null hypothesis, and conclude with at least 95% confidence that pithouse attribute patterning differs between the Upper San Juan and Northern Rio Grande, we initially notice statistical differences across five categories. However, we need to take a closer look, as the results are a bit misleading.

Looking at Room Shape we see that difference in attribute patterning is driven by the presence of d-shaped and rectangular pithouses within the Northern Rio Grande (Figure A.1). The same can be said for Structure Containment, as the difference in attribute patterning is caused primarily by the presence of post, adobe and stone structures (Figure A.3). The difference in Circular Hearth frequency is influenced by the use of d-shaped and rectangular shaped hearths in the Rio Grande (Figure A.5). In other words, although many traits occur in different frequencies between the Upper San Juan and Northern Rio Grande, three of the five traits that are typical of the Northern Rio Grande occur more frequently in the Upper San Juan, and only two occur less frequently. These results suggest there is much greater continuity between Late Pueblo I Upper San Juan pithouses and Developmental Northern Rio Grande pithouses than previous studies have suggested. I also want to emphasize that I would not expect the attribute frequencies to be identical between subregions, even if they were produced by the same people, as there is one hundred years of history between the Upper San Juan samples and the Late Developmental Northern Rio Grande samples.

It is also important to note, however, that late Pueblo I Upper San Juan pithouses are characterized by a unique suite of traits that were not listed in Lakatos and Wilson (2012) and thus, not included in the comparative analysis. Again, these traits include partial earthen benches, molded adobe milling bins, and bifurcated vent tunnels (Sesler and Hovezak 2002). In looking at

Lakatos' (2006:Table 26 and Table 27) data, not a single bench is recorded for any structure in the Rio Grande and no mention is made of molded adobe milling bins or bifurcated vent tunnels.

Site reports with pithouse components dating to the early Pueblo II period (AD 900-1000) within the Tewa Basin also make no mention of any of these characteristics (McNutt 1969; Skinner et al. 1980; Stubbs and Stallings 1953; Stubbs 1954). Furthermore, Wendorf and Reed (1955), citing unpublished site reports for Arroyo Negro (LA 114), Mocho (LA 191), Tesuque Valley (LA 742), and Pindi Pueblo (LA 1) underline a lack of classic 'San Juan Anasazi' pithouse characteristics such as encircling benches, recesses over ventilators, four or more pilasters, and south/southeast orientation at these sites dating to between AD 936 (LA 742) and AD 1194 (LA 191).

While work by Lakatos (2006, 2007) establishes a convincing case that Northern San Juan and Northern Rio Grande pithouse architecture reflect distinct architectural traditions, a reasonable case can be made that the Upper San Juan pithouse tradition was not distinct. When scholars refer to the 'San Juan Anasazi' in the context of migration, they are typically referring to the Northern San Juan area west of the La Plata River rather than Upper San Juan area to the east. For example, when commenting on the general architectural style of Developmental period pithouses in the Rio Grande, Wendorf and Reed (1955:208) state, "The Rio Grande Anasazi kivas are more reminiscent of the Basket Maker III-Pueblo I pithouses of the San Juan Anasazi. Apparently, the Rio Grande Anasazi failed to participate in the architectural developments which were occurring farther west in the Chaco-San Juan areas". In this case, they are alluding to the fact that the Rio Grande Anasazi (Tewa Basin settlements) do not resemble pithouses seen in either the Chaco or Mesa Verde region. Instead, they seem to resemble more traditional

Basketmaker III-Pueblo I pithouses, the likes of which can be seen in the Piedra and Navajo Reservoir/Fruitland District of the Upper San Juan region.

In a similar vein, despite casting a wide net in assessing potential sources of Northern Rio Grande pithouse architecture, McNutt (1969:102) references Wendorf and Reed's (1955) comment in suggesting, "The data given above do indicate that early Rio Grande structures are similar to certain Pueblo I-II structures of the Chaco-San Juan area". In doing so, McNutt (1969) is specifically referring to pithouses within the Upper San Juan that are part of the Rosa ceramic tradition that contain ventilators, ashpits, hearths, sipapus, and four-post roof supports, specifically one cited by Roberts (1930) in the Piedra District. Again, similar architectural styles have been described in the Fruitland/Navajo Reservoir District as well (Eddy 1966; Hovezak and Sesler 2002a; Sesler and Hovezak 2002; Wilshusen and Wilson 1995; Wilshusen et al. 2000).

Thus, there is a certain conservative nature to the architecture displayed within the Upper San Juan (Wilshusen and Wilson 1995). Fowles (2013:75-100) believes that the material culture of tenth and eleventh century Taos sites reflect the rejection of all things Chaco and that this rejection originated in the Piedra district. In fact, Fowles (2013:87-93) advocates for a tenth century migration of proto-Tiwa speakers from the Piedra District into the area around Taos based on similarities in material culture and oral tradition. If a lack of 'Chaconess' can be used as a line of evidence in support of migration from the Upper San Juan into the Taos area, then it seems plausible to extend such an argument into the Tewa Basin given that Fowles (2004:159-182) has made similar arguments about Northern Rio Grande cultural traditions.

Fowles (2004:159-174) does just that, to a certain extent, in speaking to the lack of 'Chaconess' of the material culture at LA 835 as evidence of local cultural autonomy. He does argue that the presence of a Great Kiva at LA 835 most likely was inspired by non-local factors, perhaps in an attempt to participate in the burgeoning Chacoan culture area. While Fowles (2004:170) does refer to the presence of similar great kivas/oversized kivas in the San Juan Basin (namely those at Shabik'eschee and Tohatchi Village), he does not reference those recorded in the Upper San Juan in the Fruitland/Navajo Reservoir District (Eddy 1966; Sesler and Hovezak 2002; Wilshusen and Van Dyke 2006) as another potential area of influence. Perhaps, rather than an attempt to semi-participate in the Chacoan world, the presence of a Great Kiva at LA 835 was an indication of the presence of migrants with ties to Great Kivas in late Pueblo I/early Pueblo II Upper San Juan communities.

In fact, there a question as to if great kivas were part of the initial Chacoan architectural canon at all. In his assessment of communal architecture associated with early (Basketmaker III) Chacoan communities, Windes (2015) states that while present in early communities, great kivas within Chaco Canyon itself do not make an appearance until the mid-AD 1000s. Instead, Windes (2015) believes community organization was more like that seen at McPhee village, containing u-shaped roomblocks, oversized pithouses, and ritual pithouse usage. While parallels have been made between Late Pueblo I communities and Chacoan Great House communities based on similarities in settlement layout (Wilshusen 2010; Wilshusen and Wilson 1995; Wilshusen and Van Dyke 2006), these comparisons tend to either be with Great House communities outside of Chaco canyon itself and/or Great House communities that post-date the Pueblo II period.

In the next section, I will present the results of my ceramic analysis. First, I will describe the ceramic profile of settlements pre-AD 900 within the Navajo Reservoir/Fruitland District of the Upper San Juan and pre-AD 900 settlements within the Middle Rio Grande. Then, I will describe the ceramic profile of settlements between AD 900-1000 within the Tewa Basin and compare those with the two subregions. Finally, I will evaluate the evidence against expectations associated with both hypotheses.

4.6 Results of Data Analysis: Ceramics

Upper San Juan. As mentioned previously, there are three main decorated ware production areas within the San Juan drainage. The two most germane to my own research are the Piedra ceramic tradition and the Rosa ceramic tradition, generally associated with the regions west and east of the La Plata River, respectively. Ceramics from the Piedra tradition (Northern San Juan) typically contain crushed igneous rock temper, plain and neckbanded grey ware and matte mineral painted black-on-white decorated ware. Ceramics from the Rosa tradition (Upper San Juan) typically contain sand or quartzite temper, predominantly plain and neckbanded utility ware and glaze-painted black-on-white decorated ware (Chuipka 2008; Sesler and Hovezak 2002; Simpson 2016). When glaze paint is found in the Northern San Juan, it often serves as an indicator of Upper San Juan connections (Wilshusen and Ortman 1999). While the use of a phase-based nomenclature for these ceramic types implies a temporal distinction between the two, Simpson (2016) argues that such a distinction is no longer reflective of reality, as both sand and crushed rock tempered ceramics have been found in the Upper San Juan as early as AD 700 (Allison 2010; Simpson 2011).

The most significant archaeological contributions to our understanding of the Upper San Juan subregion include work done by Roberts (1930) in the Piedra District of southwest Colorado (Dittert et al. 1961), Eddy (1966), Hall (1944) in the area near the current location of the Navajo Reservoir, Wilshusen and Wilson (1995) at Cedar Hill, and Wilshusen and others (2000) at Frances Mesa. For the purposes of my own research, I will focus my ceramic analysis on Piedra phase sites located within the Navajo Reservoir/Fruitland District that may be associated with the large-scale exodus from the Upper San Juan during the late Pueblo I/early Pueblo II period (Wilshusen and Wilson 1995; Sesler and Hovezak 2002; Potter et al. 2012). Ideally, an understanding of the ceramic profiles of these surveyed areas dating to the late ninth and early tenth century should provide us with a representative sample for comparison with similar profiles derived from sites within the Northern and Middle Rio Grande.

Figure 4.4 illustrates ceramic profiles of eight mid-to- late Pueblo I sites within the Navajo Reservoir/Fruitland District. Despite considerable variability in ceramic assemblages in the Navajo Reservoir/Fruitland District, assemblages dating to the mid-to-late Pueblo I/early Pueblo II period can generally be characterized as containing a preponderance of plain gray ware, low frequencies of red ware and crushed rock tempered Piedra Black-on-white as the most frequent decorated white ware (Sesler and Hovezak 2002). Stylistically, Piedra Black-on-white is similar to other contemporaneous wares from other traditions such as Kana'a Black-on-white, Drolet Black-on-white, and Kiatuthlanna Black-on-white as may be difficult to differentiation from Pueblo II types such as Mancos Black-on-white and Cortez Black-on-white if its distinctive line work is not present (Wilson 2012a).

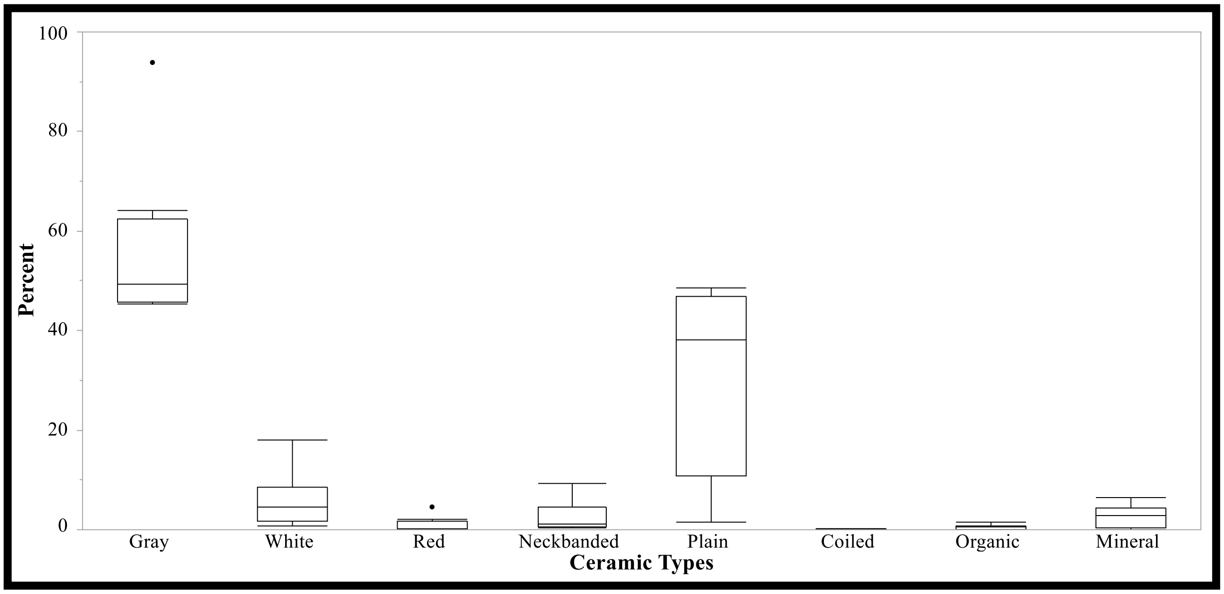

Figure 4.4 Mid-to-Late Pueblo I Upper San Juan Ceramic Profile
Note: Categories in box plots are not mutually exclusive. Data an aggregation of Cedar Hill (LA78533, LA82977, LA79489), Frances Mesa (LA66704, LA66705, LA68328), and Navajo Reservoir (LA4195, LA4380). Navajo Reservoir from Eddy (1966:Tables 16a/b), Cedar Hill from Wilson (2002:Table 1.7), and Frances Mesa from Wilshusen and others (2000:Table 8.4). Ceramics for which temper was not recorded were excluded from calculations. Organic category includes Rosa B/W, and mineral category includes Piedra B/W. Navajo Reservoir ceramic assemblages only include Pueblo Period Ceramic types listed in Eddy (1966:Table 2), thus Cortez B/W and Red Mesa B/W excluded from calculations. Trace amounts of Buff B/R & La Plata B/R present in Navajo Reservoir assemblages.

Middle Rio Grande. Figure 4.5 represents a compilation of ceramic tallies from a total of nine Middle Rio Grande early Developmental (AD 600-900) sites. While lacking the temporal granularity of the Fruitland/Navajo Reservoir District data, the continuity of ceramic traditions during the early Developmental period within the Middle Rio Grande should allow these data to serve as adequate proxies for ceramic profiles prior to the initial population increase within the Tewa Basin.

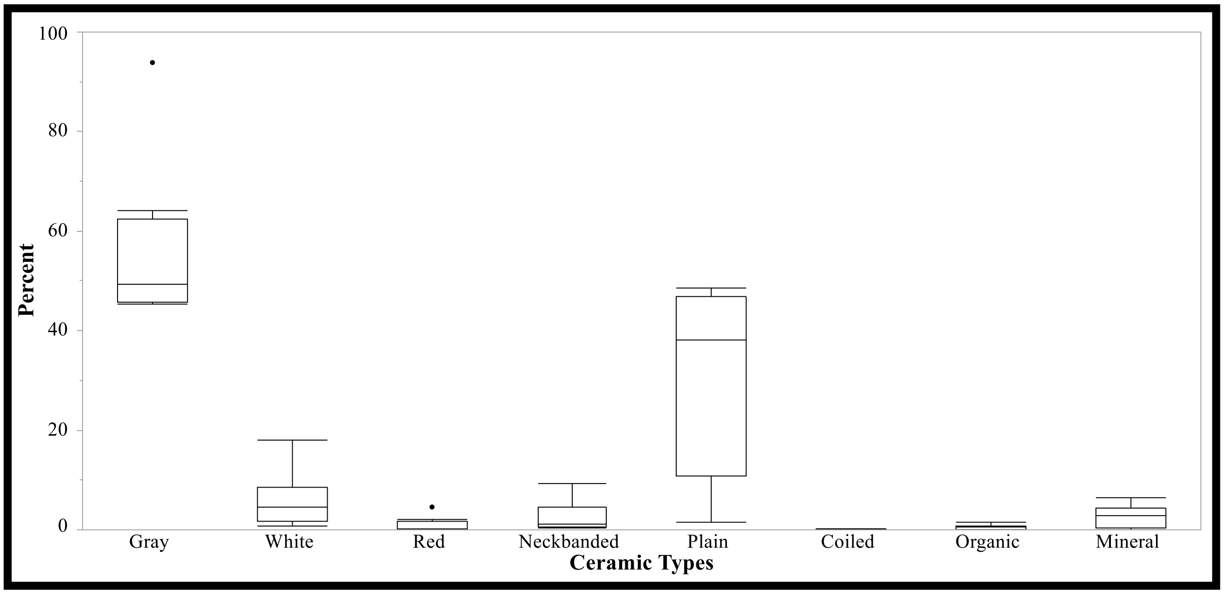

Figure 4.5 Early Developmental Middle Rio Grande Ceramic Profile
Note: Categories are not mutually exclusive. Data an aggregation of Pena Blanca (LA265, LA6169, LA6170, LA115862), State Road 44 (LA9193, LA32698) and Jemez River (LA25862, LA109129) sites. All data from Lakatos and Post (2012:Table 9.2). Unidentified wares and types excluded from calculations.

What we see is that early Developmental Middle Rio Grande assemblages are characterized by a preponderance of gray ware, followed by low frequencies of white, red, and brown ware. San Marcial Black-on-white is the most distinctive decorated ware (Lakatos and Wilson 2012). San Marcial Black-on-white was first described by Mera (1935) and is one of the earliest decorated white ware types identified in the Middle Rio Grande. It is usually found in assemblages that also contain Mogollon brown ware and is considered to exhibit Mogollon stylistic influences (Lakatos and Wilson 2012; Wilson 2012b). Trace amounts of Red Mesa Black-on-white ceramics have also been found associated with State Road 44 and the Jemez River sites within the Middle Rio Grande.

These ceramic trends hold from roughly AD 700 to around AD 900 when Red Mesa Black-on-white rapidly replaces San Marcial Black-on-white and the production of neckbanded gray ware becomes more frequent in sites in and around the Tewa Basin (Lakatos and Wilson 2012). Figures 4.6 and 4.7 illustrate the significant increase in textured gray ware between AD 900 and 1000, while Figures 4.8 and 4.9 illustrate the notable increase in the presence of Upper San Juan ceramics which, while not specifically described, probably refers to an increase in neckbanded gray ware and the presence of fine sand and/or sandstone tempered ceramics.

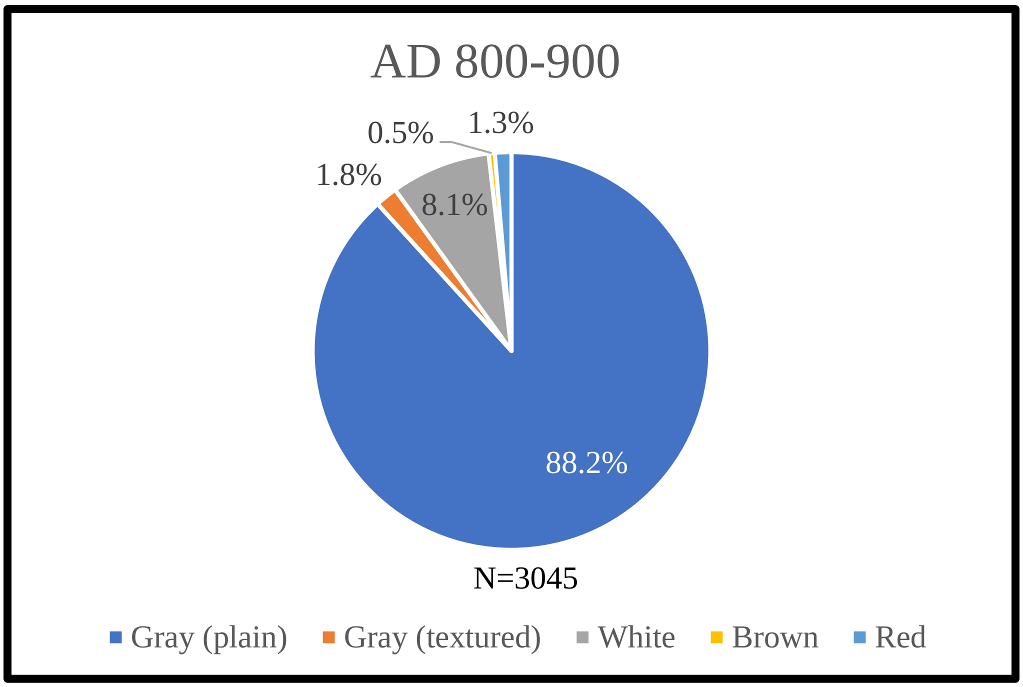

Figure 4.6 Early Developmental Rio Grande Ceramic Ware (Lakatos and Wilson 2012:Figure 7.7)

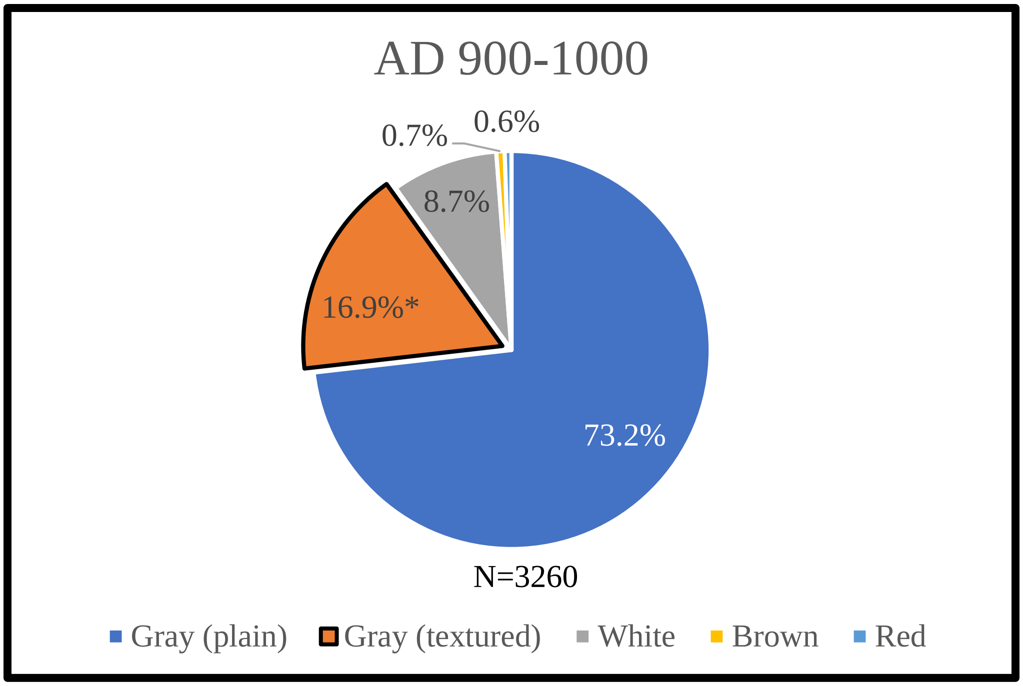

Figure 4.7 Late Developmental Rio Grande Ceramic Ware (Lakatos and Wilson 2012:Figure 7.7).

Note: *Denotes statistically significant difference from Figure 4.6 at the 95% CI.

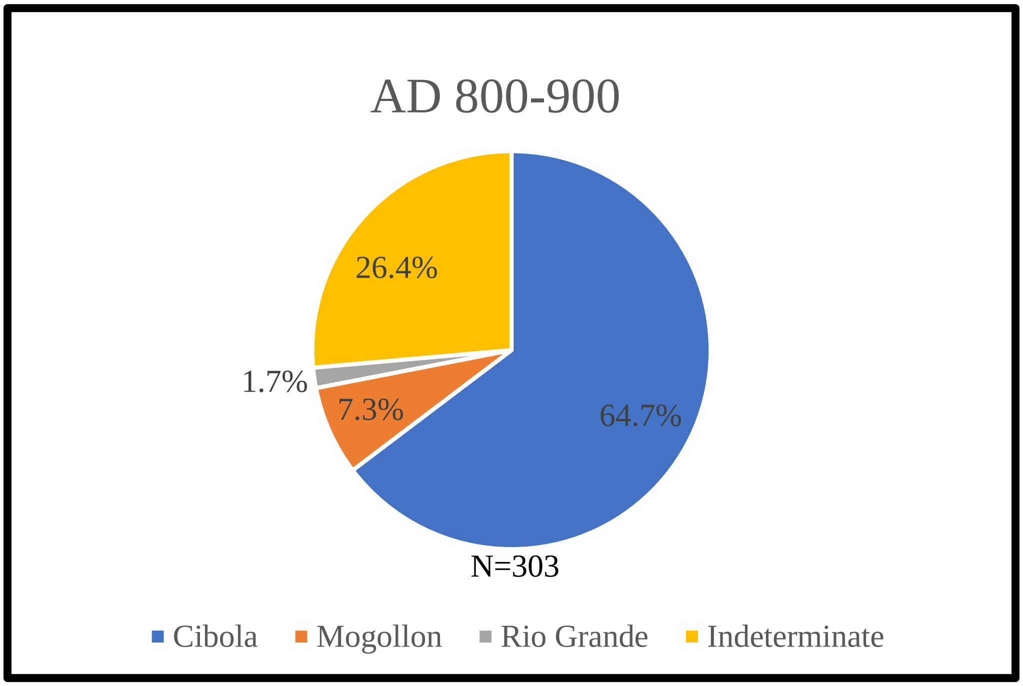

Figure 4.8 Early Developmental Rio Grande Ceramic Traditions (Lakatos and Wilson 2012:Figure 7.8)

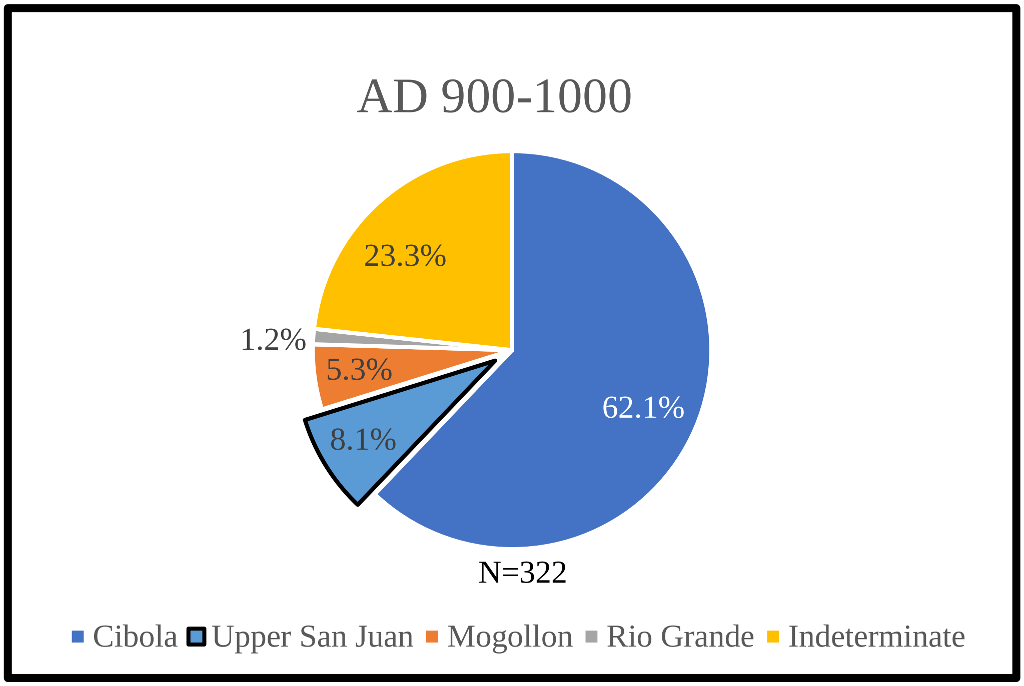

Figure 4.9 Late Developmental Rio Grande Ceramic Traditions (Lakatos and Wilson 2012:Figure 7.8)

The Albuquerque area of the Middle Rio Grande has been described as a cultural transition zone, where both Ancestral Puebloan and Mogollon cultural complexes overlap. The Albuquerque area was not strongly affiliated with either the central San Juan Basin cultural complex nor the southern Mogollon cultural complex. Instead, it reflected a mix of both architectural and ceramic traits from both regions in a sort of "weak patterning" (Tainter and Plog 1994:176). Indicative of this are the numerous ceramic assemblages containing Mogollon brown ware, Mogollon-style influences reflected in production of San Marcial Black-on-white, and pithouses with short, stepped lateral entrances (Tainter and Plog 1994). As the Mogollon culture area has been associated with the ancestral Zuni language (Clark 2007; Ford et al. 1972 Shaul 2014), similar arguments have also been made for the appearance of Ancestral Puebloan ceramic types within Zuni ceramic assemblages during the rise of the Chacoan culture area (Tainter and Plog 1994).

Northern Rio Grande. Figure 4.10 represents a compilation of ceramic tallies for three Late Developmental Period Tewa Basin sites. Although the predominant gray ware continues to be plain ware, the presence of neckbanded gray ware is noticeable. While Red Mesa Black-on-white is present at all sites, the dominant white ware tends to be Kwahe'e Black-on-white and Santa Fe Black-on-white, reflecting the length of pottery production and occupation at these sites (Schillaci and Lakatos 2017).

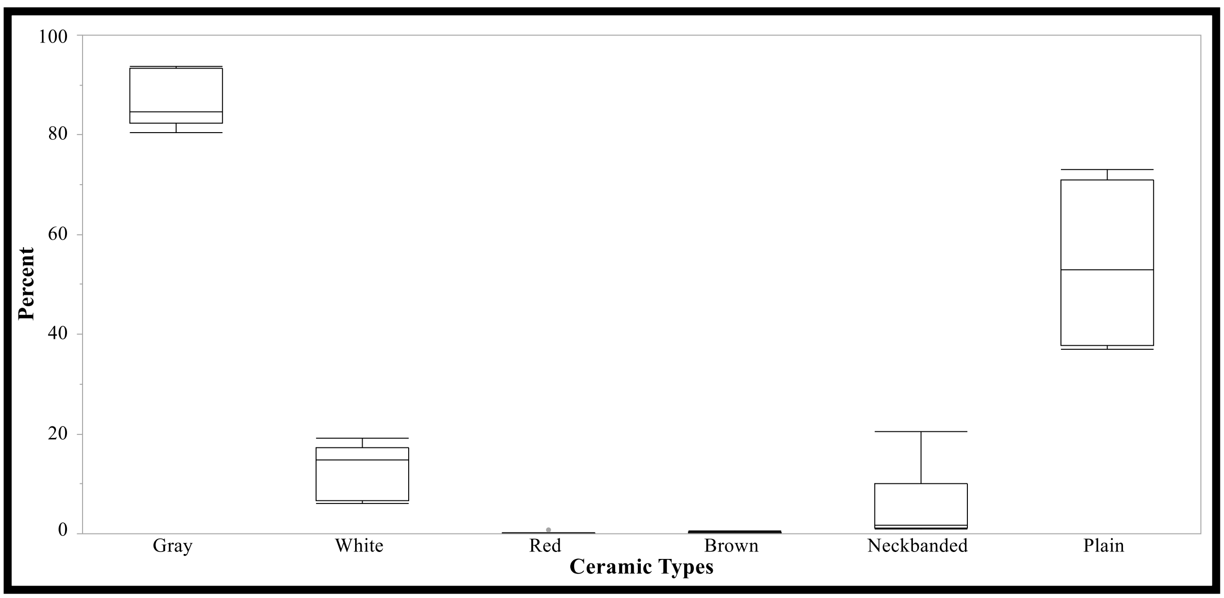

Figure 4.10 Tenth Century Northern Rio Grande Ceramic Profile
Note: Categories are not mutually exclusive. Data an aggregation from the following sites: Pojoaque Grant (LA 835), Tesuque By-Pass (LA 3294) and Nambe Falls (X29SF17, X29SF18, X29SF45). Pojoaque Grant data from Ortman personal communications (2016); Tesuque By-Pass data from McNutt (1969:Figures 3 and 6); Nambe Falls data from Skinner et al. (1980:Tables 21, 28, and 34).

Developmental ceramic trends within the Tewa Basin began with the arrival of Red Mesa Black-on-white as the predominant decorated white ware between AD 900 and 1050 (Wilson 2013). Red Mesa Black-on-white quickly transitioned into and overlapped with the production of Kwahe'e Black-on-white, considered to be influenced by Red Mesa Black-on-white and the first indigenously developed member of a line of decorated white ware known as the Rio Grande ceramic series, beginning between AD 975 and 1023 and ending around AD 1200 (Wilson 2013; Schillaci and Lakatos 2017). The production of Kwahe'e Black-on-white was, in turn, followed by the production of Santa Fe Black-on-white around AD 1175. To better understand these sequences, Table 4.4 replicates ceramic typologies and associated date ranges for the principal decorated white ware types from the Northern Rio Grande. This table follows the original ceramic sequence of decorated Northern Rio Grande white ware first established by Wendorf (1954) and Wendorf and Reed (1955), and incorporates revised ceramic dates for Kwahe'e Black-on-white and Santa Fe Black-on-white established by Schillaci and Lakatos (2017).

Table 4.4 Rio Grande Ceramic Types and Associated Production Dates

Pottery Type	Local/ Trade ware	Current date range[1]	Revised early production date[2]	Period[3]
Red Mesa B/W[2]	Local/Trade	AD 900-1050		Early Developmental/ Pueblo II
Kwahe'e B/W	Local	AD 1050-1200	AD 975-1023	Early Developmental/ Pueblo II
Santa Fe B/W	Local	AD 1175-1350	AD 1127-1145	Late Developmental/ Pueblo III
Wiyo B/W	Local	AD 1275-1400		Late Coalition/Pueblo III
Biscuit A	Local	AD 1350-1450		Early Classic/Pueblo IV
Biscuit B	Local	AD 1400-1450		Middle Classic/ Pueblo IV
Tsankawi B/C	Local	AD 1500-1600		Late Classic/Pueblo IV

Note: [1] Dates from Ortman (2012); [2] Date ranges include appearance of trade ware from the southern San Juan Basin (Cibola region) and local production; [3] Periods derived from the use of revised production dates; Source: Schillaci and Lakatos (2017:Table 1).

First identified by Mera (1935) as Chaco 2 Black-on-white and later described and named by Gladwin (1945), Red Mesa Black-on-white can be considered a pan-Puebloan occurrence, suddenly appearing in varied locations such as the Colorado Plateau, Northern Mogollon, Rio Abajo, Northern Jornada, and Northern Rio Grande during the late ninth and tenth centuries (Wilson 2012c). It is frequently associated with sites in Chaco Canyon and in areas near the west drainage of the Puerco River (Hays-Gilpin and Van Hartesveldt 1998). Red Mesa Black-on-white pastes tended to be hard and temper typically consisted of sand, sherd or sherd and sand. Puerco Valley varieties contain porous gray, dark gray or gray-brown pastes and sherd temper (Wilson 2012c). Wilson (2013) suggests that Red Mesa Black-on-white originated in the Chaco-San Juan region and arrived in the Tewa Basin in the form of trade ware based on his own analysis of paste and temper, while arguments for a combination of local production and importation have also been made (Wiseman and Olinger 1991; Scheick 2007; Schillaci and Lakatos 2017).

The pan-Puebloan appearance of Red Mesa Black-on-white led many archaeologists to view stylistically similar ceramics predating the appearance of Red Mesa Black-on-white as predecessors. Examples include Cortez Black-on-white within the Northern Rio Grande (Wilson 2012a), Arboles Black-on-white within the Upper San Juan (Wilson 2012a) and Kiathuthlanna Black-on-white, Gallup Black-on-white, and Escavada Black-on-white in the Chaco-San Juan region (McNutt 1969:100).

Early archaeologists such as Mera (1935), Wendorf (1954), Wendorf and Reed (1955) and McNutt (1969:102) generally believed that the sudden appearance of Red Mesa Black-on-white and the subsequent transition to Kwahe'e Black-on-white along with circular, east-to-southeast orientated pithouses generally containing a sipapu, hearth/ashpit/deflector, four support posts and a ventilator in the Tewa Basin in the late ninth and tenth centuries indicated the arrival of Puebloan migrants, most likely from the Chaco-San Juan region. Consequentially, cultural development in the upper Rio Grande was viewed as lagging behind that of the Chaco-San Juan region.

Later work by Wiseman (1995) on a reassessment of tree-ring dates from LA 835 suggested that cultural development at the site paralleled that within Chaco Canyon. It is interesting to note that McNutt (1969:100) defines the Chaco-San Juan region very broadly when discussing Puebloan migration, describing it as the area "…south of Mesa Verde, west of the East Puerco, north of the Datil Mountains, and east of the Chuska-Lukachukai-Carrizo

Mountains". Thus, early references to the 'Chaco-San Juan' area really encompass two distinct subregions: Chaco Canyon and Mesa Verde (i.e., the San Juan Basin and the Northern San Juan).

Referring to the Red Mesa material culture found at Tesuque By-Pass, McNutt (1969:81) states that, "There is virtually no evidence that this culture originated within the upper Rio Grande Valley; apparently it was introduced by Pueblo immigrants from some other area, beginning at *ca*. 900 AD" (McNutt 1969:81). In an analysis of ceramic design elements, Washburn (2013) argues that Upper San Juan style ceramics (Rosa/Piedra/Arboles Black-on-white) are very similar to ceramics made in the Gallina culture area (Gallina Black-on-white), and Northern San Juan ceramics (Cortez Black-on-white, Mancos Black-on-white) are very similar to the Red Mesa Black-on-white and Kwahe'e Black-on-white found from the Tewa Basin down to Albuquerque. Thus, stylistic similarities in ceramic design support Puebloan migration patterns into the Northern Rio Grande (Washburn 2013).

While trace amounts of Red Mesa Black-on-white have been found in Rio Grande sites prior to AD 900 (Lakatos and Post 2012; Wiseman and Olinger 1991) scholars generally believe that the appearance of Red Mesa Black-on-white is due to migration and/or trade from areas such as Chaco Canyon (Schillaci and Lakatos 2016, 2017; Wilson 2013) or the Northern San Juan (Washburn 2013; Wilshusen 2015; Wilshusen and Van Dyke 2006; Windes 1993; Windes and Van Dyke 2012). Similar arguments have been made in the Taos region, where the appearance of Red Mesa Black-on-white and Kwahe'e Black-on-white is associated with migration from the Piedra District in Upper San Juan in the tenth century (Fowles, 2004:183-188, 2013:75-100). The population increase within the Tewa Basin and importation of associated Cibola ceramic types closely correlates to the rise of Chaco Canyon during the Early Bonito Phase (AD 900-1000), and arguments have been made (Fowles 2004:159-182; Schillaci and Lakatos 2016) that this could be due, in part, to the importance of trade between the two regions in turquoise from the Cerrillos mines (Warren and Mathien 1985) and obsidian from the Jemez mountains in the Northern Rio Grande (Cameron and Sappington 1984; Duff et al. 2012).

In particular, the Pojoaque Grant site (LA 835) is held up as a flagship site reflecting a strong Chacoan tradition due primarily to the presence of Red Mesa Black-on-white and a Great Kiva (Stubbs 1954; Wiseman and Olinger 1991). In his assessment of LA 835, Fowles (2004:164-172) takes a different perspective, viewing the assortment of construction techniques, such as the use of jacal, slab-footed walls and post-reinforced walls and dispersed settlement layout as an extension of local Pueblo I traditions, rather than influenced by migrants from Chaco. Contrary to both options stated above, I would argue that the combination of an early tenth century occupation, dispersed settlement layout, great kiva, east-to-southeast oriented pithouses, and Red Mesa Black-on-white ceramics is more consistent with the cultural footprint of late Pueblo I/early Pueblo II sites in the Upper San Juan than early Pueblo II Chacoan Great House communities.

Others (Boyer et al. 2010; Lakatos 2006, 2007; Schillaci and Lakatos 2016, 2017) have proposed regions such as the Rio San Jose Valley, Rio Puerco (east) Valley, Santo Domingo Basin and Albuquerque Valley as source areas for the population increase within the Northern Rio Grande, while advocating against large-scale migration from the Northern San Juan as a primary factor in material culture development. In a recent paper, Schillaci and Lakatos (2017) posit that their revised dating of Kwahe'e Black-on-white (AD 975-1023) coincides with the tenth century population increase within the Tewa Basin and emergence of the Tewa language, which suggests that the development of Kwahe'e Black-on-white was autochthonous to the Tewa Basin and the first in a line of local decorated ware traditions.

Assessing the Data: Ceramics. Ceramic trends in the Middle Rio Grande are generally characterized by the presence of San Marcial Black-on-white in association with plain gray and brown ware, reflecting contact with the Mogollon culture area (Tainter and Plog 1994; Lakatos and Wilson 2012). Piedra phase Upper San Juan ceramic trends are, in turn, characterized by the presence of plain and neckbanded gray ware and the dominance of Piedra Black-on-white ceramics (Wilson 2002). Both ceramic traditions appear to be culturally distinct with neither one exerting culture influence on the other. Developmental period ceramic trends within the Tewa Basin are initially represented by an increase in textured gray ware (the most distinctive being neckbanded) and arrival of Red Mesa Black-on-white style ceramics (Lakatos and Wilson 2012).

There is a strong consensus among Southern Origin proponents that Red Mesa Black-on-white was both imported from the Chaco-San Juan Basin and locally produced within the Tewa Basin beginning in the late ninth or early tenth century, with Kwahe'e Black-on-white developing locally from Red Mesa Black-on-white and/or variations of it (Schillaci and Lakatos 2017; Wilson 2013; Wiseman and Olinger 1991). These arguments echo earlier ones made by Mera (1935), McNutt (1969) Wendorf (1954), and Wendorf and Reed (1955). Those proposing a local origin for the Tewa Basin population (Boyer et al. 2010; Lakatos and Wilson 2012; Schillaci and Lakatos 2016, 2017) avail themselves of this line of reasoning when advocating for cultural continuity and intrinsic population growth within the Tewa Basin during the tenth century.

However, others (Gladwin 1945; Judd and Allen 1954; Kidder and Shepard 1936; Washburn 2013) see both Red Mesa Black-on-white and Kwahe'e Black-on-white as having strong stylistic roots in the San Juan drainage, and its sudden appearance in the Tewa Basin need not imply a source in Chaco Canyon. At least in one instance, its arrival has also been associated with migration directly from the Upper San Juan into the Northern Rio Grande (Fowles 2004:200-208, 2013:87-100).

If this is the case, then the development of subsequent decorated white ware types such as Kwahe'e Black-on-white could possibly have an external origin story rather than an internal one. It is also important to mention that early Pueblo II (AD 900-1000) Upper San Juan sites, while much fewer in number than in earlier periods, also contained evidence of neckbanded gray ware (Arboles Neckbanded), Bancos Black-on-white, Mancos Black-on-white, Cortez Black-on-white, and Arboles Black-on-white (Eddy 1966). At least three of these (Mancos Black-on-white, Cortez Black-on-white, and Arboles Black-on-white) are stylistically very similar to Red Mesa Black-on-white (Washburn 2013; Wilson 2012d).

The appearance of Red Mesa Black-on-white or variations of it have been linked to four different migration streams during the tenth century: (1) Northern San Juan/Upper San Juan to Chaco Canyon (Windes 1993; Windes and Van Dyke 2012; Wilshusen 2015; Wilshusen and Van Dyke 2006); (2) Upper San Juan to the Gobernador/Largo and Gallina areas (Washburn 2013); (3) Upper San Juan to the Taos region (Fowles 2004:200-208, 2013:87-100); (4) Chaco-San Juan region to the Tewa Basin (Boyer et al. 2010; Mera 1935; McNutt 1969; Schillaci and Lakatos 2016, 2017; Wendorf 1954; Wendorf and Reed 1955). Given the seemingly ubiquitous nature of Red Mesa Black-on-white style ceramics, the general confusion surrounding its typology and the arguments for migration linked to the appearance of this ceramic type, it seems plausible to consider a fifth option – that of migration from the Upper San Juan directly into the Tewa Basin.

Despite the seemingly convoluted nature of the ceramic data, we can say the following about material culture in general: (1) in terms of pithouse morphology, tenth century Northern

Rio Grande pothouses are more similar to Late Pueblo I pithouses of the Upper San Juan than they are to Late Pueblo I pithouses of the Northern San Juan; (2) in terms of pithouse attributes, Upper San Juan pithouses are more similar to Northern Rio Grande pithouses than they are different; (3) there is continuity in ceramic traditions between archaeological sites in the late ninth century and early tenth century Upper San Juan and tenth century sites in the Northern Rio Grande; (4) there is discontinuity between pre-AD 900 Middle Rio Grande ceramic traditions and those found in tenth century Northern Rio Grande sites.

These data do not strongly favor one hypothesis over another. At the very least they suggest that we cannot reject the Upper San Juan as a potential source area for the initial Northern Rio Grande population based purely on pithouse attributes or ceramic traditions.

An interesting twist to this debate has been the addition of linguistic prehistory. While I will go into this in much more detail in the following chapter, it is important to briefly mention it here, as it is typically cited as a line of evidence in support of the Southern Origin hypothesis regarding tenth century Tewa Basin migration (Schillaci and Lakatos 2016, 2017; Schillaci et al. 2017). The general argument is that the population increase within the Tewa Basin corresponds to agreed-upon period for a Proto-Tiwa-Tewa language split (Ford et al. 1972; Ortman 2012) as well as the appearance of Red Mesa Black-on-white ceramics and conservative, eastern oriented, pithouse architectural traits (Schillaci and Lakatos 2016, 2017).

If the Red Mesa Black-on-white ceramic tradition and accompanying pithouse architecture originated in the Chaco-San Juan regions to the west of the Middle Rio Grande, then it is plausible that those who carried it up into the Tewa Basin during the AD 900s were Proto-Tiwa-Tewa speakers. Similar scenarios have been proposed by Mera (1935), Wendorf (1954), Wendorf and Reed (1955), Peckham in Ford et al. (1972), Steen (1977), Boyer et al. (2010), and (Schillaci and Lakatos 2016, 2017).

The main counter argument to this line of thinking comes from recent historical linguistic research on Tanoan languages (Ortman 2012:160-161; Shaul 2014:101-107, 2018:46-49), which identifies the Colorado Plateau as the most likely homeland. Furthermore, the same research views Proto-Tiwa-Tewa as having developed outside of the Northern Rio Grande. If this is indeed the case, then this line of evidence strongly supports the Northern Origin hypothesis. If, instead, the evidence suggests that Proto-Tiwa-Tewa separated within the Northern Rio Grande, then it would favor of the Southern Origin hypothesis. I will attempt to navigate the intricacies of this debate by applying linguistic prehistory to the question of Proto-Tiwa origins in the following chapter.

CHAPTER 5

LINGUISTIC PALEONTOLOGY

5.1 Linguistic Paleontology: A Primer

Linguistic paleontology, also known as linguistic prehistory, linguistic archaeology, and applied historical linguistics, combines historical linguistic methodologies with lines of evidence from other disciplines such as archaeology, bioanthropology, ethnohistory, history, etc. to infer information about the history and culture of speakers of ancient languages. Linguistic paleontology is frequently used when textual evidence (i.e., written records) of ancient languages does not exist; thus, linguists must avail themselves exclusively of lexical evidence. Linguistic paleontologists apply the comparative method to modern languages with the objective of reconstructing proto-languages from which information on ancient cultural complexes, homelands, and languages distributions can be assessed (Millar and Trask 2015:343).

The assumption is that if one can demonstrate that an ancient language had a term for a specific object or practice, then one can also assume that speakers of the language were familiar with it (Millar and Trask 2105:342). When applying the comparative method, linguists first look for systemic sound correspondences across large vocabulary sets between languages that are presumed to derive from a common linguistic ancestor. As sound change tends to be regular, patterns of sound correspondences are considered compelling evidence in favor of genetic relations between languages. If distinct sound correspondence sets are found, these terms are considered cognate–that is, they are considered to have descended from a common ancestor. From these correspondence sets, linguistics attempt to reconstruct plausible proto-sounds from based on what is known about the rules of sound change. This entire process is called ‘comparative reconstruction’, and by carefully applying the comparative method, linguists can reconstruct not only proto-sounds, but proto-lexicons as well (Millar and Trask 2015:191-208).

From these reconstructed proto-lexicons, linguistic paleontologists can begin to learn more about the cultural context to which they refer. For example, the presence of terms in Proto-Mayan for ‘maize’, ‘corncob’, ‘metate’, ‘to grind’, and ‘to harvest’ suggests that the Maya possessed maize agriculture. Additional terms for ‘lord’ and ‘slave/tribute’ suggests a highly stratified social structure. Linguistic paleontologists also look for clues in plant and animal names that might suggest possible homelands of language families. The area of greatest overlap of the largest number of plant and animal species is considered the most probable homeland location of a particular language family. Of course, one must be careful to minimize the impact of the independent invention of terms and/or the use of loan translations (calques) in the identification of cognates. Either can lead to the misidentification of cognates and thus incorrect inferences about cultural items in proto-lexicons. Climate change can also affect the accuracy of inferences based on modern day distributions of plants and animals, although the use of techniques from paleobotany and palynology can help mitigate this risk (Campbell 2013:418-424).

Finally, an additional method for locating linguistic homelands is called *linguistic migration theory*. This method combines the subgroupings of a language family with their geographic distribution under assumptions inherent in Sapir’s (1949[1916]:455) *center of gravity* model. In this model, one would determine the minimum number of moves necessary to trace specific languages from their present geographic location back to their subgroups, and in turn, these subgroups back to their original location. The final location would be the most likely homeland of this language family, as it should contain the greatest number of higher-order (older) subgroups. Not surprisingly, caveats exist regarding linguistic migration theory as well. One could imagine scenarios in which multiple subgroups of a single language family were forced to move to an entirely new area due to some sort of cataclysmic event (drought, warfare, natural disaster, etc.). An alternative scenario with the same result would be one in which ‘pull’ factors (resource abundance, established social networks, etc.) were strong enough such that multiple subgroups would be attracted to the same area (Campbell 2013:430-431). It is important to keep these caveats in mind as both are germane to questions surrounding Rio Grande migrations.

While considered controversial by some and subject to certain limitations, linguistic paleontology has made important contributions to our understanding of ancient languages and cultures (Campbell 2013:405-446; Millar and Trask 2015:344-350) in both the Old World and the New World. It has been used with varying levels of success in the identification of homelands for Proto-Algonquian, Proto-Salishan, Proto-Uralic and Proto-Finno-Ugric, Proto-Indo-European, and Proto-Uto-Aztecan (Campbell 2013:424-430). In the next section I will present two of the most well-known case studies in the application of linguistic paleontology in both Europe and North America. These case studies will serve as examples of both the usefulness of this type of methodology as well as some of its drawbacks before diving into specific details regarding how it has been applied to the Tanoan language debate.

Linguistic Paleontology in the Old World. Linguistic paleontology’s best-known contribution may be its involvement in the Indo-European homeland problem. While European scholars had extensively investigated Indo-European languages by the mid-nineteenth century with the intent of locating the original homeland of Proto-Indo-European (PIE), they had done so entirely using historical linguistic frameworks. The incorporation of archaeological evidence did not occur until the mid-twentieth century with the publication of Marija Gimbutas' (1963) work, *The Indo-Europeans: Archaeological Problems*, in which she posited that the incursion of a nomadic, patriarchal society governed by kings and nobles which she called the "Kurgan culture" (820) appeared across substantial portions of Europe, the Caucasus and present-day Turkey during the second half of the third millennium BC. While Gimbutas' (1963) steppe model (Figure 5.1) has been critiqued by many IE scholars (Mallory 1989:182-185; Krell 2003; Renfrew 1987:197-210), the most frequently cited alternative is Renfrew's (1987) 'wave of advance' model (Millar and Trask 2015:349).

Renfrew (1987:77-86) critiqued the attempt to reconstruct proto-lexicons via the comparative method based on problems such as name transfer, or the application of a proto-term to something other than what its reconstruction would suggest. For example, the existence of the IE term for 'salmon', *l*aks* suggests that the homeland was near the Baltic Sea. However, this term is also applied to species of trout, which complicates the matter. Without additional evidence, the original meaning of the term *l*aks* may be 'trout', which people simply transferred to other things as they moved across the landscape. The tendency for people to transfer an existing name for flora or fauna to something different upon arriving in a new territory can complicate the use of proto-lexicons in identifying prehistoric homelands (Millar and Trask 2015:343-346). Renfrew (1987:90-94) also critiqued the application of normative migratory (i.e., culture history) frameworks in associating the appearance of European cultures such as the Bell Beakers and Corded Ware with a Kurgan expansion.

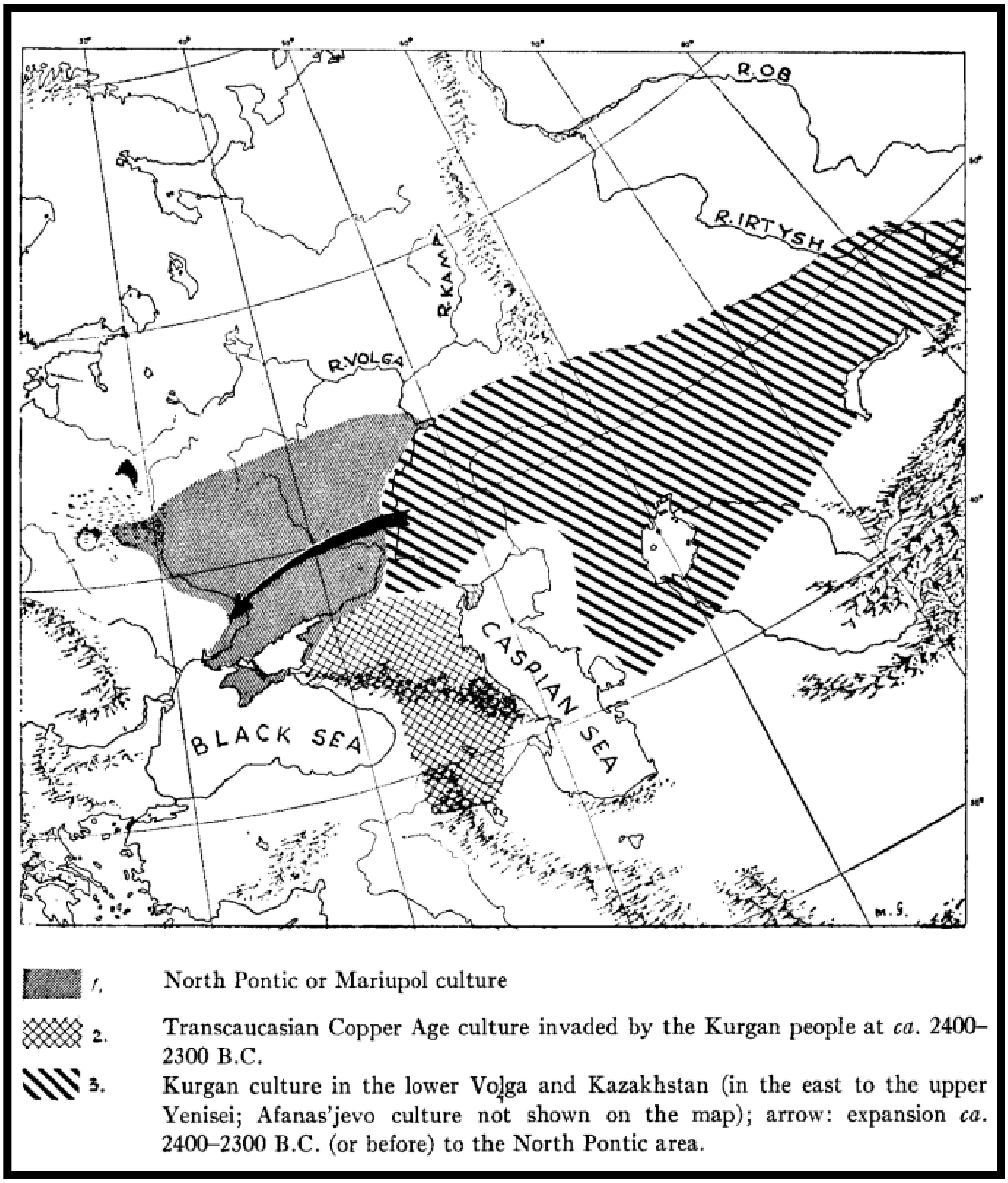

Figure 5.1 Proposed Cultural Groups Pre-Indo-European (IE) Expansion (Gimbutas 1963:819)

Instead, Renfrew (1987:90-91) proposed that expanding exchange networks and increasing peer-polity interactions were more appropriate explanations for the advent of these two cultural complexes than standard explanations linked to diffusion or migration. Furthermore, Renfrew (1987:125) did not see how such a large-scale replacement of indigenous languages by IE could occur without the appearance of a new "exploitative" technology. According to Renfrew

(1987:125-131), the introduction of farming was the most likely option; as such, he advocated for a scenario in which the expansion of IE languages occurred hand-in-hand with the expansion of farming out of Anatolia, or modern day Turkey (Figure 5.2), via Ammerman and Cavalli-Sforza's (1973) 'wave of advance' model. In this model, population expansion would occur via slow, population 'ripples' from the origin of the disruptive technology at a steady rate.

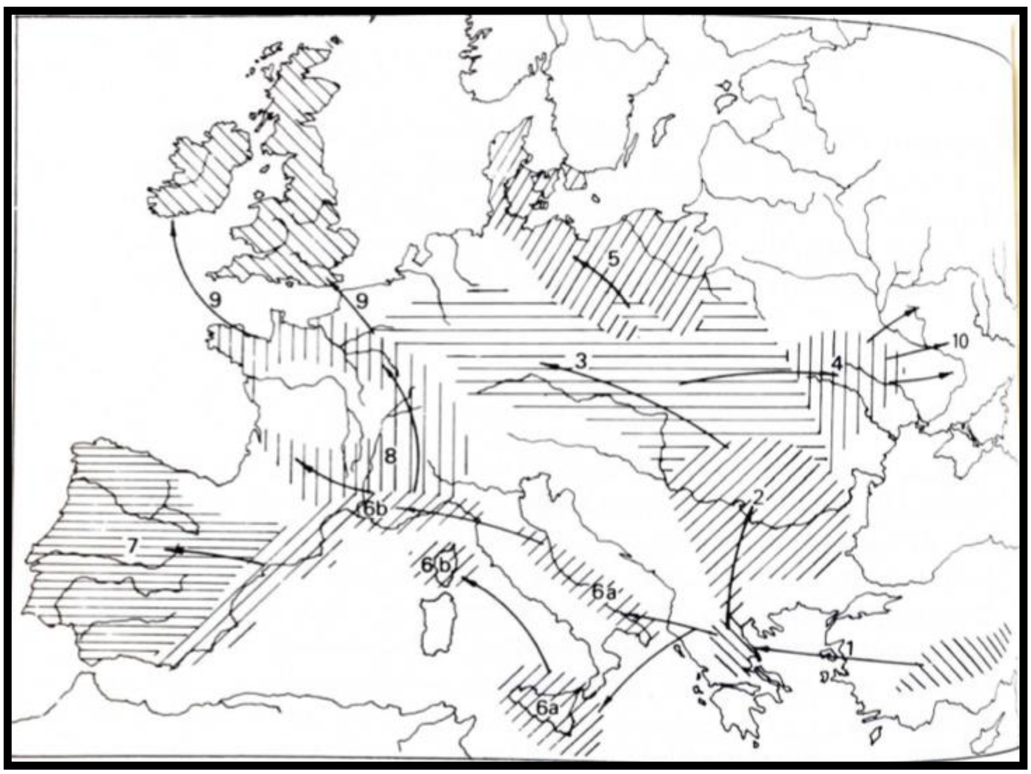

Figure 5.2 Proto-Indo-European (PIE) Anatolian Expansion Model (Renfrew 1987:160)

The primary problem with Renfrew's (1987) hypothesis was the disjunction between the archaeological evidence for the expansion of agriculture in Europe around 10,000 years ago and linguistic reconstructions of the likely diversification of PIE around 6,000 years ago. This temporal 'gap' would require IE languages to remain relatively homogenous over a large area for an extended period of time, a concept at odds with general notions of language diversification and change (Mallory and Adams 2006). On the other hand, Gimbutas (1963) has been critiqued for excessive confirmation bias in her interpretation of the evidence (Millar and Trask 2015:348-350). Ultimately, there is no agreed upon best explanation for the spread of IE languages, but a recent summary of the evidence by Anthony and Ringe (2015) strongly suggests the steppe area north of the Caucasus and west of the Ural Mountains. Ultimately, the comparative method has been used with great success in revealing important aspects of PIE culture such as the most likely homeland, social structure, kinship relations, technology, economy, and ideology (Campbell 2013:406; Millar and Trask 2013:345).

Linguistic Paleontology in the New World. In North America, Proto-Uto-Aztecan (PUA) is the most well-known and important language family to the reconstruction of western North American prehistory (Shaul 2014:14). What makes it so is the wide swath of territory associated with Uto-Aztecan speakers – from southern Idaho all the way down to El Salvador and Nicaragua (Figure 5.3). It is the only language family that touches areas both inside and outside of tropical zones (Hill 2001).

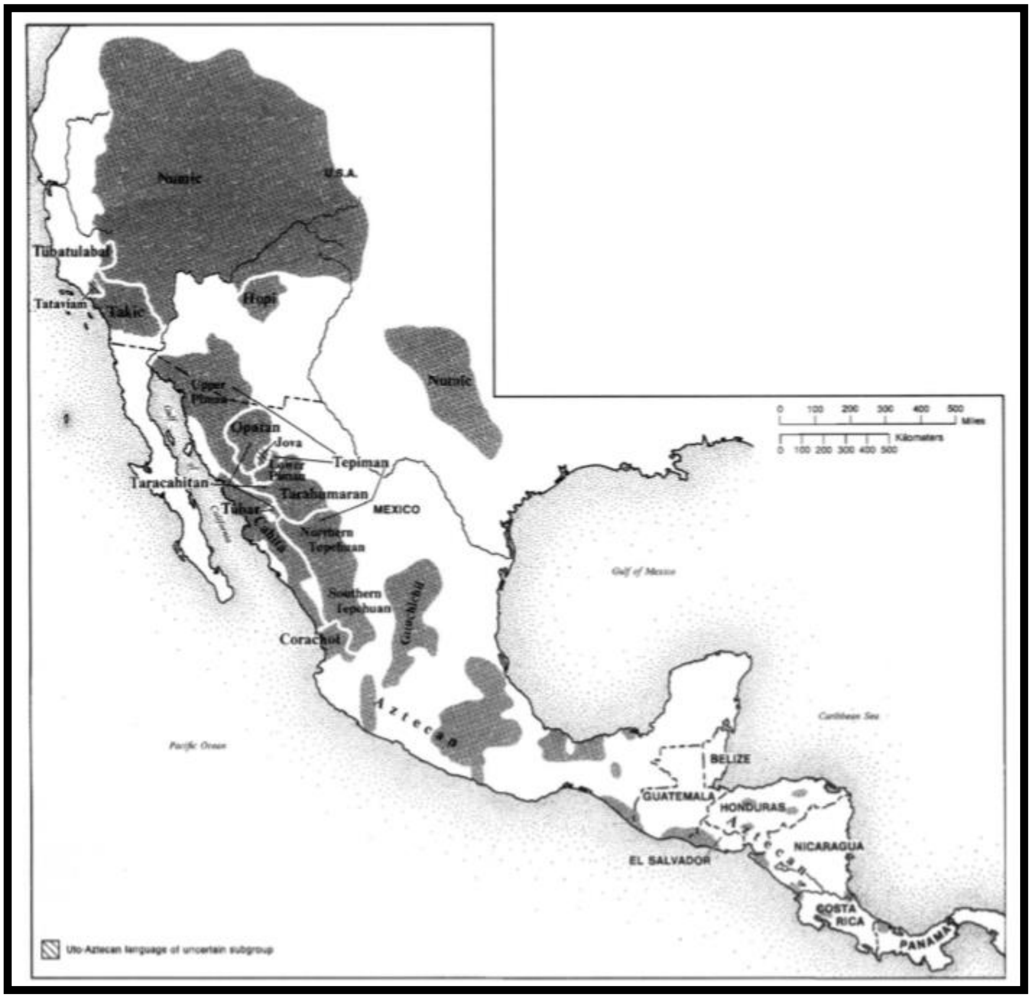

Figure 5.3 Distribution of Uto-Aztecan Languages (Miller 1983:114)

Scholars have engaged in substantial debates regarding the homeland of PUA with most of them falling into one of two factions. The first is represented by those who propose a northern origin and view PUA speakers as originally hunter-gatherers (Campbell 1999; Fowler 1983; Hale and Harris 1979; Merrill et al. 2009; Merrill 2013; Shaul 2014:34-41, 82-84, 97-98), while the second is represented by those who propose a Mesoamerican origin (Bellwood 2000, 2001; Bellwood and Renfrew 2002; Diamond and Bellwood 2003; Hill 1996, 2001, 2002a, 2002b, 2008, 2010) and view PUA speakers as agriculturalists who spread maize agriculture and their language north.

Early arguments for a northern PUA homeland derive from Fowler's (1983) reconstructed PUA terms for plants and animals that indicated the existence of a dialect chain beginning in southern California and continuing southeast through Arizona down into northern Mexico based on the known distribution of such flora and fauna (Figure 5.4). Fowler (1983) also suggested that the PUA dialect chain was later split up into a northern and a southern division. This Northern Origin model assumes that PUA hunter-gathers adopted agriculture as it spread north from Mesoamerica, where it originated with Mixe-Zoquean speakers (Hill 2001).

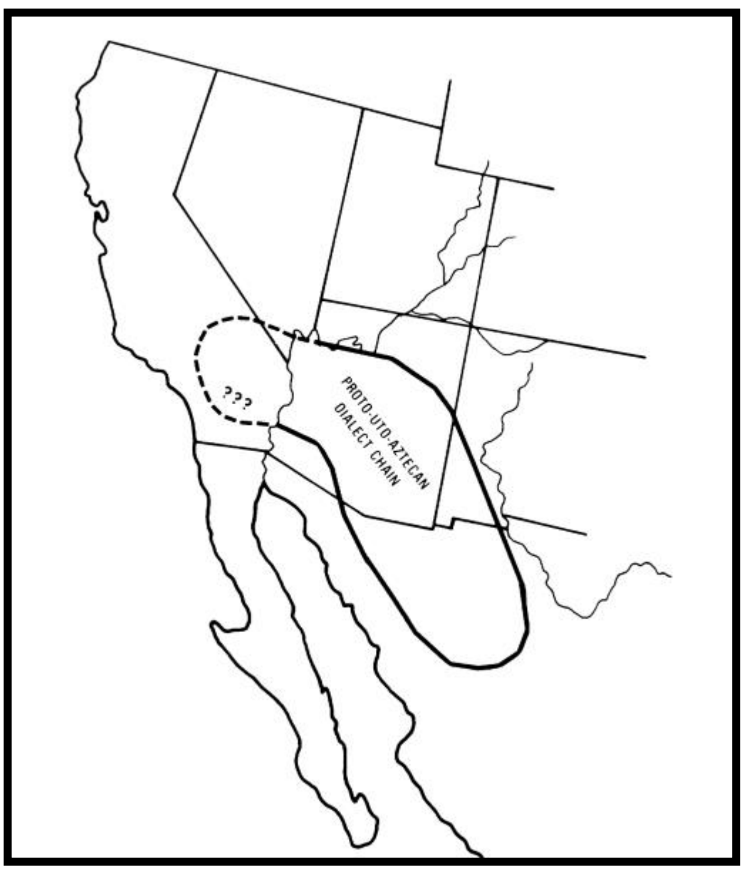

Figure 5.4 Location of Proto-Uto-Aztecan (PUA) Dialect Chain (Fowler 1983:235)

The Southern Origin model is best represented by the work of Bellwood (2000, 2001), Bellwood and Renfrew (2001) and Hill (2001, 2002a, 2002b, 2008, 2010). Bellwood (2000, 2001) proposes that population dispersal is the primary impetus for language spread and that population dispersal was driven by the Neolithic Revolution. As centralized, state-imposed language requirements are the exception rather than the rule in prehistory, wide-spread distributions of language families were more due to colonization than to conquest, trade, or something else. In addition, Bellwood (2000, 2001) emphasizes that many established proto-language reconstructions have 'rake-like' rather than 'tree-like' shapes, which is indicative of a relatively quick dispersal of the proto-language.

In making his arguments, Bellwood (2000, 2001) cites early work by Hill (1996) on Proto-Southern Uto-Aztecan (PSUA) maize-related cognate sets as evidence that PUA speakers were an agricultural society with a Mesoamerica homeland. Later work by Hill (2001, 2002a, 2002b, 2008, 2010) expands on earlier research, incorporating historical linguistic analyses of Uto-Aztecan and Proto-Tanoan vocabulary in arguing for a Proto-Northern Uto-Aztecan/Proto-Tanoan contact zone. She also further fleshes out arguments for a PUA maize and pottery proto-lexicon by incorporating ethnohistoric, ethnographic, and archaeological evidence to support her hypothesis (Hill 2001, 2002a, 2002b, 2008, 2010).

Arguments against the Bellwood-Hill model have come primarily from Merrill et al. (2009, 2010), Merrill (2012, 2013) and Shaul (2014:220-254, 332-334). Proposals put forth by Merrill et al. (2009, 2010), Merrill (2012, 2013) and Shaul (2014:34-40) identify a Great Basin homeland for PUA (Figure 5), with maize agriculture arriving in the U.S. Southwest via group-to-group diffusion. The area of greatest overlap of flora and fauna proto-terms in PUA is in the Great Basin, while a lack of PUA terms for species such as 'pinyon', 'oak' with prehistoric distributions from the southern Great Basin into Mesoamerica would exclude this region, leaving the west central Great Basin as the most likely homeland (Merrill 2009, 2010; Shaul 2014:36-38). In addition, a lack of internal consistency in NUA and SUA maize-related cognates, cultural continuity in material culture, evidence supporting a foraging vocabulary base for all of Hills' reconstructed proto-terms, alternative scenarios for the spread of the AL*Mexico gene, and the likelihood that certain logistically mobile foraging communities were already preadapted to agriculture (Merrill 2013; Shaul 2014:220-254).

Figure 5.5 Location of Proto-Uto-Aztecan (PUA) Homeland (Merrill et al. 2009:21020)

Key Takeaways. Before discussing how linguistic paleontology relates to Tanoan languages, I want to summarize the most crucial points from the above literature review. The first is that the conclusions drawn from linguistic paleontology are by no means definitive. A substantial margin for error exists due to the assumptions inherent in the interpretation of reconstructed proto-terms as well as which proto-terms we choose to emphasize over others (e.g., Hill's maize-specific reconstructions versus Merrill and others' flora reconstructions). In addition, incongruencies can exist between dates for events derived from the archaeological record and dates derived for language families from historical linguistics (e.g., critiques of Renfrew's PIE hypothesis). Finally, additional lines of evidence, such as that from genetics (e.g., the presence of the AL*Mexico gene) can also complicate the narrative. Despite these shortcomings, linguistic paleontology has made significant contributions to improving our understanding of ancient population movement and homelands and I believe it is the best option currently available for the investigation of such questions.

5.2 Linguistic Paleontology and Tanoan Languages

In the U.S. Southwest, attempts to correlate archaeological cultures with established languages may be best known due to their relationship with the question of Tewa origins, which in turn, is linked to debates centered around the thirteenth century depopulation of the Mesa Verde region. Tewa is part of the Kiowa-Tanoan language family, which is comprised of the following languages: Kiowa, Tiwan (Northern and Southern), Tewan (Rio Grande and Arizona), Towan (Jemez), and Piroan (Piro) (Shaul 2014).

The present-day distribution of Tanoan languages (Figure 5.6) is highly suggestive of prehistoric migrations (Davis 1959), which itself is supported by substantial evidence linked to

Tewa and Tiwa oral histories (Ellis 1967; Harrington 1919; Jeancon and Roberts 1924; see Fowles 2004:56-122, 2013:87-93 and Shaul 2014:102 for a summary of Taos oral history). The crux of the debate revolves around developing a sequence of population movement that best explains the substantial linguistic diversification and distribution of present-day Tanoan languages in a way that also fits with the archaeological record of human occupation within the Rio Grande (Figure 5.6). Given the substantial complexity and sheer volume of literature applied in attempts to sufficiently address this problem, I will henceforth focus only on the literature germane to my own question of Proto-Tiwa-Tewa diversification.

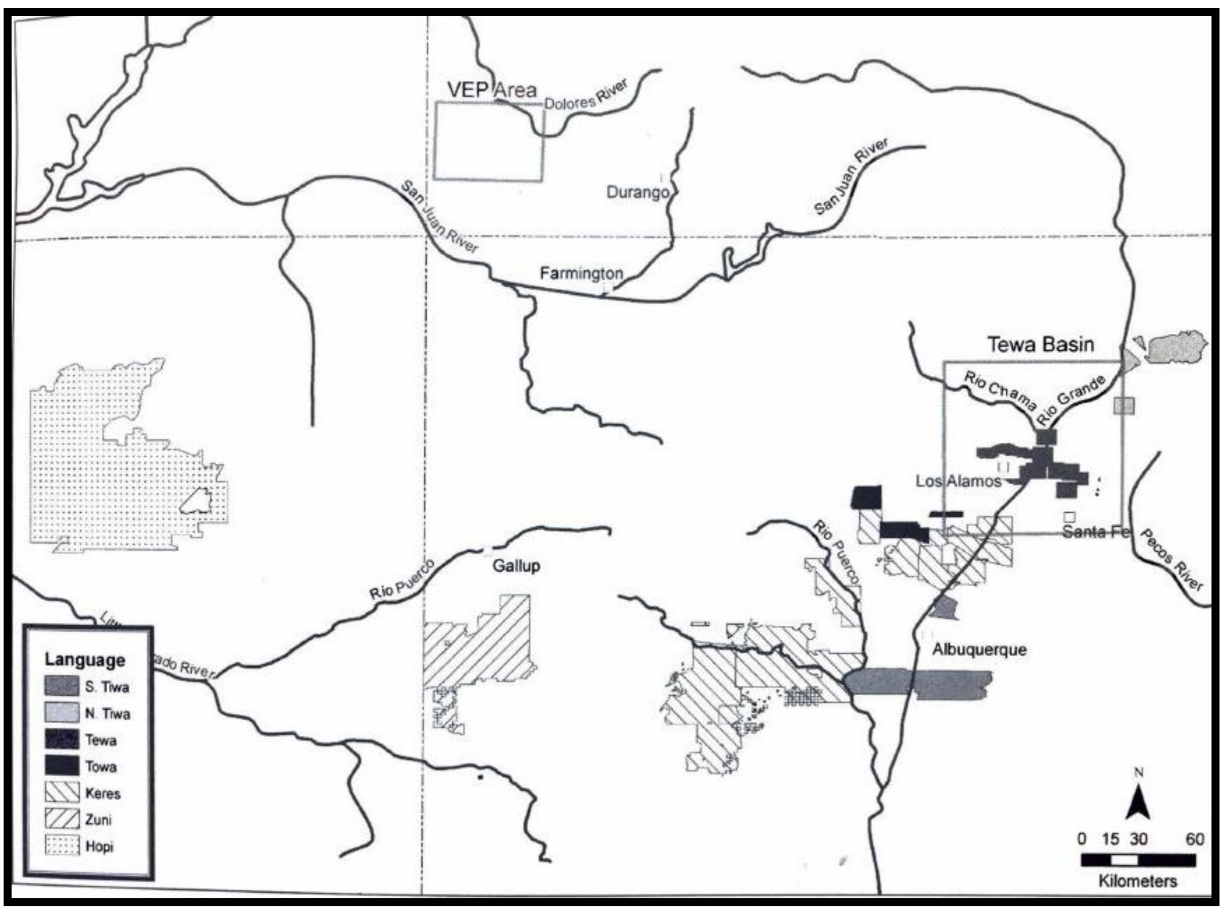

Figure 5.6 Distribution of Present-Day Tanoan Languages (Ortman 2012:Figure 6.1)

Early attempts at correlating archaeological cultures with the question of Tanoan language diversification were undertaken by Mera (1935), Hawley (1937), Reed (1949), Wendorf and Reed (1955), Ellis (1967), and Ford and others (1972). More recent studies have been attempted by Boyer et al. (2010), Schillaci and Lakatos (2016, 2017), and Schillaci and others (2017). These studies have generally relied on dates derived from glottochronology, and assumptions inherent in center of gravity models. However, other than Ortman (2012), there have not been any attempts to apply linguistic paleontology to the Tanoan homeland question.

5.3 The Ortman Narrative

Scott Ortman's (2012) impressive work on Rio Grande migrations and Tanoan languages is the most well-known current approach to the long-standing question of Tewa origins. In it, Ortman (2012:125-152) applies an analytical framework integral to historical linguistics known as the comparative method to reconstruct linguistic genealogies of the Tanoan language family by systematically comparing their descendant languages. Following Ross (1997, 1998), Ortman (2012) analyzes patterns of overlapping sound innovations to identify episodes of lectal differentiation and linkage rejoining. Similar to Ross (1997), I will use *lect* in the sense of both a language and a dialect. According to Ross (1997) *lectal differentiation* refers to the presence of overlapping sound innovations across daughter languages that are indicative of a gradual extension of speakers of those languages from their original homeland. Typically subsumed under the 'wave model' of depicting language genealogies, *lectal differentiation* is associated with the maintenance of cohesive, yet less intense, social networks between speakers of different lects. Ross (1997) contrasts *lectal differentiation* with *linkage breaking*, or *language fissure*, which implies a rapid lectal separation, and consequentially, rapid dissolution of established social networks.

Ortman (2012:125-152) applies these models to Tanoan language data and concludes that his results demonstrate that Proto-Tewa and Proto-Tiwa have very few overlapping innovations. These results are evidence of the presence of *linkage breaking*, and a relatively quick separation of Proto-Tewa speakers from Proto-Tiwa speakers. Again, following Ross (1997), Ortman (2012:147) argues that migration is the most likely reason for a scenario in which Proto-Tiwa develops unique innovations not present in Proto-Tewa, as Proto-Tiwa speakers would have had to be quickly isolated from Proto-Tewa speakers. According to Ortman's (2012:150-151) model, after leaving their source area, Proto-Tiwa speakers would have then formed a dialect chain in their target area, which later differentiated into ancestral dialects of Taos, Picuris, Southern Tiwa and most likely Piro as well. This dialect chain would have been split later by in-migrating Tewa speakers.

In performing his comparative analysis, Ortman (2012:145) identifies three phonological innovations (changes in pronunciation) unique to Proto-Tiwa that occurred before it split into northern (Taos) and southern (Isleta) dialects. For the purposes of my own research, the most relevant of these is the change from *s > ɬ. This is a change from a voiced alveolar fricative /s/ to a voiceless dental/alveolar lateral fricative /ɬ/. The presence of a voiceless dental/alveolar fricative, while considered rare among the world's languages, is present among numerous language families in North America, from the Artic and Columbia Plateau to northern and coastal California. Outside of this area, it is also found in the Alabama-Mississippi area (among the Muskogean language family) and in the U.S. Southwest among Tiwa, Zuni, and Apachean speakers (Shaul 2018).

Ortman (personal communication, 2016) believes that such a unique sound change is evidence of language contact within the Northern Rio Grande between Proto-Tiwa speakers and speakers of another language, most likely a dialect of Zuni. Ortman's (personal communication, 2016) argument about Proto-Tiwa/Zuni contact is based, in large part, on current work by Shaul (2014:104-105) that supports his Tanoan dialect chain model and introduces the possibility of Proto-Tiwa contact with speakers of 'Language X', a potential language that pre-dates the arrival of Tanoan within the Rio Grande (Shaul 2018).

In proposing language contact as the prime factor in the development of a voiceless dental/alveolar lateral fricative (/ɬ/), Ortman (2012:149-150) connects to arguments made in Thomason and Kaufman (1988) about contact-induced change. The types of innovations Ortman (2012) identifies, including the /ɬ/, are typically associated with a language-contact scenario in which speakers of the target language (TL) fail to learn the TL perfectly and carry over linguistic traits from their native language into the TL. Thus, speakers of TL_1 (native speakers of TL) and TL_2 (non-native speakers of TL) compromise on a third version of TL, known as TL_3, which contains the 'agreed-upon' (note that this can be either consciously or subconsciously) linguistic traits from TL_2 (Thomason 2001).

To date the linkage breaking between Proto-Tewa and Proto-Tiwa, Ortman (2012:162) leverages a method of dating language separation first proposed by Edward Sapir (1949[1916]) known as 'words and things'. The idea is that if linguists can reconstruct a proto-term through the comparative method, then it is safe to assume that this word refers to something that was known to speakers of that language in the past. Therefore, if this word refers to an object or thing whose first appearance is datable in the archaeological record, then one can develop a reasonable estimate for the minimum length of time that a proto-language was spoken. The best type of proto-terms for this analysis are those referring to domesticated crops and material culture, as they are more easily dated in the archaeological record (Ortman 2012:162-163). For example, Ortman (2012:164) reconstructs proto-lexical items for ‘corn’, ‘squash’, ‘oak’ and ‘spruce’ and proposes that these proto-terms, combined with the lack of proto-terms linked to agriculture such as ‘to plant’ and ‘field’, suggests that the PKT speakers were foragers linked to Eastern Basketmaker cultural groups who were in the process of adopting maize horticulture.

Ortman (2012:164) proposes that the latest date Tewa could have split from Tiwa would have been AD 920, based on archaeological dating of the initial appearance of squash and cooking pots (AD 725 to AD 920) in the northern U.S. Southwest. Ortman (2012:166) also reconstructs Proto-Tiwa terms for which there are no Proto-Tewa cognates such as ‘viga’, ‘turquoise’ and ‘macaw’, whose appearances have been dated in the U.S. Southwest to between AD 980 and AD 1100. This provides the upper end of a temporal bracket that then can be used to date the Tiwa-Tewa language split to roughly between AD 920 and AD 980. Furthermore, the fact that the Proto-Tiwa word for ‘turquoise’ is a loan from Keres, along with the presence of Chaco-linked terms such as ‘viga’ and ‘macaw’, strongly suggests that Proto-Tiwa speakers were located within the Northern Rio Grande by this time and were in contact with peoples from the Chaco area (Ortman 2012:166).

Although he does not address Tiwa migrations directly, Ortman (2012:418-419) suggests that there is evidence to support an early tenth century migration of people into the Northern Rio Grande from the north. Ortman (2012) cites the existence of multiple sites in the Totah-Upper San Juan region that were abandoned right around AD 900 (Wilshusen and Wilson 1995), as well as his own biodistance analysis suggesting that ancestral Tiwa populations could be related to Totah-Upper San Juan populations. Based on Ortman's (2012:418-419) work, Figure 5.7 presents the estimated locations of Towa, Tewa, and Tiwa speakers prior to AD 920.

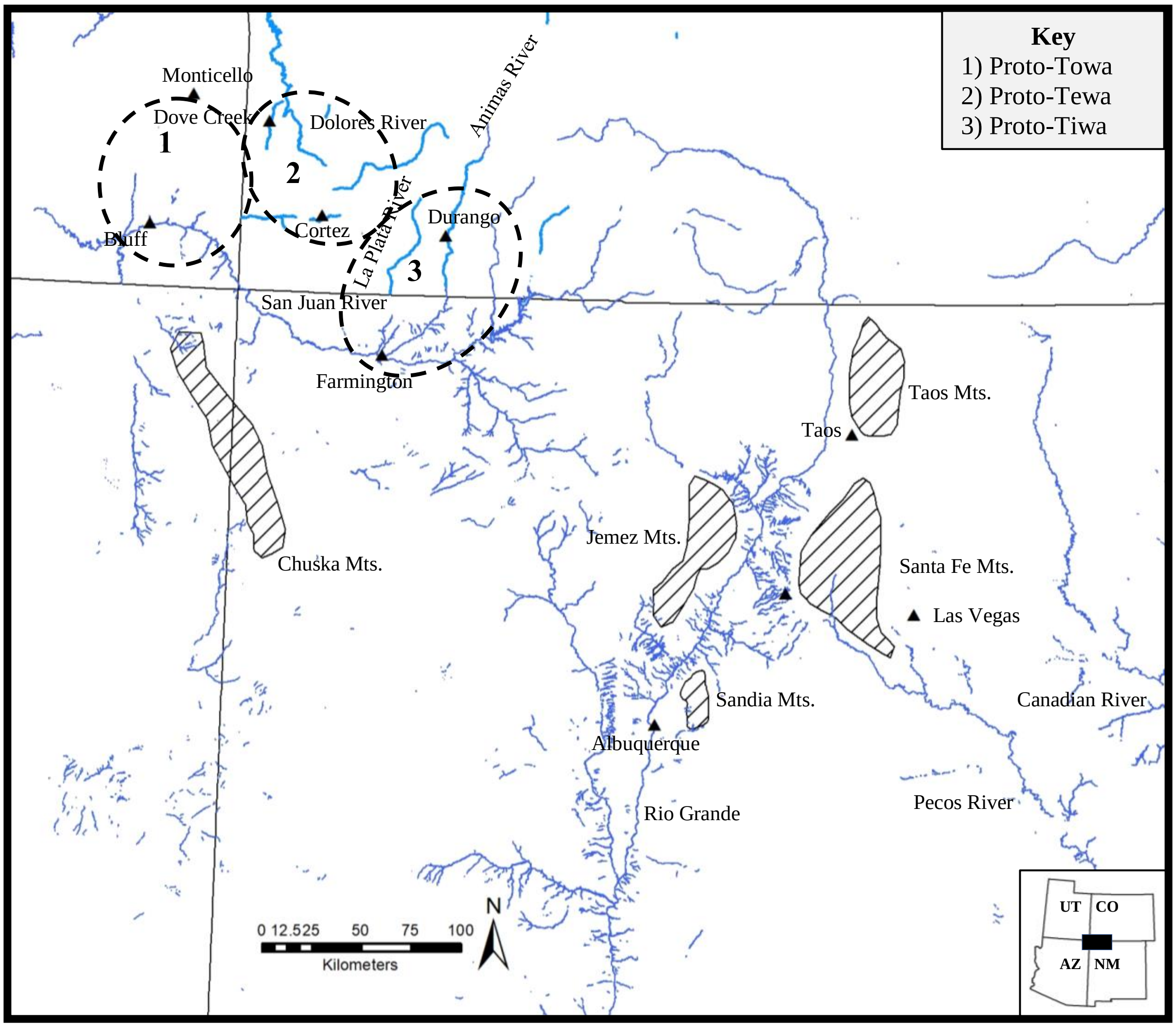

Figure 5.7 Proposed Locations of the Towa, Tewa and Tiwa Speech Communities Prior to AD 920
Note: Adapted from Ortman (2012:Figure 6.1 and D.1).

Ortman (2012:173-202) also includes an analysis of toponyms as a line of evidence supporting a northern origin for the Tewa. In doing so, he again applies Sapir's (1949[1916]:436-437) 'words and things' methodology using the assumption that toponyms that are analyzable in a language are typically generated by speakers of that language, whereas name that cannot be analyzed are can be assumed to have been coined a long time ago or are loan words. A logical assumption then would be that the donor language was the first to arrive in particular region, with the recipient language arriving at a later date. In addition, Ortman (2012:174) suggests that if toponyms in two daughter languages are cognate, then it is safe to assume that their proto-language was spoken nearby. Finally, regarding toponyms for archaeological sites, Ortman (2012) assumes that a site was not occupied prior to being named, unless it happens to refer to an existing ruin, as often is done in Navajo.

Ortman (2012:174-181) compares a list of 20 toponyms for geographic features for the San Juan Tewa and Taos Tiwa dialects. His expectation was that if Proto-Tiwa-Tewa diversified within the Northern Rio Grande, then there would be a certain number of cognates. However, if the opposite was true, then there should be more loan words from Proto-Tiwa into Proto-Tewa, as Proto-Tiwa would represent the donor language (but see Ware 2016). The results of Ortman's (2012) analysis indicate that four out of the 20 paired toponyms may be considered cognates, but none are definitely so; thus, the evidence suggests a Proto-Tiwa-Tewa diversification outside of the Northern Rio Grande.

Ortman (2012:180-181) also points out that there are pairs of toponyms for geographic features that either have transparent morphology in Taos but not Tewa (Taos Peak and Sierra Blanca Lake) or whose Tewa form incorporates Tewa terms for the Taos people (Taos Mountain and Taos Creek), which indicates that the Taos form is older than the Tewa form and constitutes additional evidence for the primacy of Proto-Tiwa in the Northern Rio Grande. In addition, Ortman (2012:181-185) demonstrates that there are no Tewa place names for sites earlier than AD 1275 in the Tewa Basin, which again supports a thirteenth century Tewa migration (but see Schillaci et al. 2017). Ortman (2012:187-202) also references multiple Tewa oral traditions that support a northern origin for the Tewa people. Finally, the fact that Tewa speakers have adopted several Taos place names (either through translations or loan words), including their name for their place of emergence (‘Sandy Place Lake’), provides additional evidence for ‘first-mover’ status for Tiwa speakers in the Northern Rio Grande (Ortman 2012:198-199).

Ortman’s (2012:77-86) analysis of paleodemographic data suggests that while intrinsic growth models could explain the population increase seen in the Northern Rio Grande prior to European contact, the spatial patterning of the settlement data contradicts this model. Ortman (2012) believes that Early Coalition period settlements on the Pajarito Plateau are indicative of migration rather than intrinsic population growth. According to Ortman (2012), intrinsic growth models (i.e., Southern Origin hypothesis) would predict a population expansion in existing Rio Grande settlements. However, population growth occurred in uninhabited areas on the Pajarito Plateau rather than existing population centers, consistent with population movement models. He also states that the scale of migration during the Late Coalition period, combined with the appearance of new villages in the Santa Fe/Santa Cruz and Chama districts, supports the arrival of larger migrant communities rather than smaller, family-sized groups. On this point, Ortman (2012:80) says, “One would not expect to see this pattern if Late Coalition population growth were due to the gradual infiltration of small groups into established communities”.

Ortman’s (2012) biodistance analysis also supports Tiwa and Tewa migrations from the north during the thirteenth century. Ortman (2012) uses four separate biodistance models (genetic distance, gene flow, genetic drift, and admixture analysis) to analyze craniometrics data from sites across the northern Southwest dating between AD 1000 and AD 1600. Ortman (2012:121) emphasizes that all four of these biodistance models support the scenario that a biological lineage native to the Rio Grande was bisected by the arrival of migrants from the Mesa Verde region in the thirteenth century—consistent with his population models.

In addition to language, place names, oral tradition, and biodistance data, Ortman (2012) describes how mapping conceptual metaphors onto the archaeological record can help with our understanding of Tewa origins. Ortman (2012:203-250) identifies specific metaphors in Tewa such as ‘pottery vessels are textiles’ and ‘buildings are containers’, that he believes are expressed archaeologically in the Mesa Verde region through both ceramic designs and settlement layout.

Finally, Ortman (2012:288-335) integrates changes in the archaeological record in the Northern Rio Grande into his multifaceted analysis. Ortman (2012) considers multiple changes in the material culture during the Coalition period to be indicative of large-scale migration. Like McNutt (1969), Ortman (2012) views the presence of carbon-painted pottery, slab metates, full-grooved axes and turkey bones at Early Coalition sites as clear cultural discontinuities related to a Mesa Verde migration. Despite this evidence, Ortman (2012:330) is aware of the lack of expected site-unit intrusions and addresses this by stating, “it appears that the pattern of change – characterized by the conspicuous absence, inversion, or obliteration of many characteristic Mesa Verde traits – suggests an overt negative commentary on the homeland society on the part of migrant groups”.

Ortman (2012:365-371) believes that this social commentary reflected in material culture is evidence of a larger religious revitalization movement that was connected to the large-scale depopulation of the Mesa Verde region. Migrants were consciously choosing which aspects of the Mesa Verde cultural complex to express and which not to. In response to the difficulties that this variegated patterning poses to standard archaeological expectations surrounding migration, Ortman (2012:369) suggests that “recurrent difficulties archaeologists have had in tracing ancient migrations using material culture … indicate that material culture continuities of any particular type are not a necessary correlate of migration".

5.4 Critiques of the Ortman Narrative

Given the breadth and depth of Ortman's (2012) work, as well as the controversial nature of it, there have been many critiques published, both formally and informally. For a good summary of them, see Boyer et al. (2010) and Ware (2016). Critiques of components of the Ortman (2012) narrative can be found in Sutton (2014), Schillaci and Lakatos (2016, 2017), and Schillaci and others (2017). Tangential critiques can be found in Lakatos (2006, 2007), Lakatos and Post (2012), and Lakatos and Wilson (2012). Other than a passing mention (Ware 2016), there has not been a direct challenge to Ortman's (2012) hypothesis of a tenth century Proto-Tiwa migration into the Northern Rio Grande. Since this question is at the center of my research, I will only describe facets of the aforementioned critiques that are directly relevant to this discussion.

Ortman's (2012) use of historical linguistics in general has been critiqued by Ware (2016) and in a more detailed fashion by Sutton (2014). Ware's critique essentially calls into question the usefulness of historical linguistics given its "contradictory conclusions" (Ware 2016:10) with regards to the PUA homeland question. He also emphasizes that Ortman's (2012) location for PKT is at odds with the 'maximum diversity' principle. Ware (2016) also disputes Ortman's (2012) 'cognate overlap' argument with regard to place names, postulating that one would expect significantly higher cognate overlap south of La Bajada and White Rock Canyon, if the Local Origin model holds, rather than in the Tewa Basin.

In his dissertation titled *Kiowa-Tanoan: A synchronic and diachronic study*, Sutton (2014:251-255) critiques the quality of Ortman's (2012) proto-lexicon reconstructions. While lauding the multi-disciplinary nature of Ortman's (2012) work, he admits that he came upon Ortman's (2012) work too late to provide a thorough review. Sutton (2014) attempts to poke holes in Ortman's (2012) conclusions regarding his reconstructions and sound correspondences. Namely, Sutton (2014) accuses Ortman (2012) of relying too heavily on too few sources and overusing what little he does know due to a lack of comprehensive training in the discipline of linguistics. However, to be fair, Ortman (2012:154-156) admits as much and was certainly aware of these issues. Sutton's (2014) primary criticism of Ortman's (2012) work is that he considered only sound correspondences and not grammatical correspondences and reconstructions. Sutton (2014) essentially dismisses most of Ortman's (2012) reconstructions, deeming them inadequate. He also critiques Ortman's (2012) use of Sapir's (1949[1916]) 'words and things' methodology based on a misunderstanding of Tewa etymologies. However, despite the significant amount of ground covered in his own internal reconstructions, Sutton (2014) does not offer explicit alternatives to Ortman's (2012) PKT hypothesis or sub-group reconstructions.

Sutton (2014:481-754) does provide numerous alternative sound reconstructions, but tends to vacillate somewhat in terms of committing to specific sub-groupings (Kiowa-Tewa, Tewa-Towa, Kiowa-Towa, etc.). However, he does allude to the strong possibility of a Kiowa homeland on the Colorado Plateau and reinforces the existence of a Tewa-Tiwa sub-group (1163-1196). Finally, Sutton (2014:662-670) confirms that the shift from a voiced alveolar fricative /s/ to a voiceless dental/alveolar lateral fricative is indeed strange, and most likely does not reconstruct back to the proto sound *s (as suggested by Ortman 2012:Figure 6.2). Although Sutton (2014) offers up a few internally reconstructed alternatives such as *t, $*k^j$, and $*k^w$, he admits that the area of 'fricative correspondence' across Tanoan sub-groups is complex and confusing and in need of additional analysis. Ultimately, Sutton's (2014) work seems to generally support Ortman's (2012) own sound correspondences and sub-groupings.

Schillaci and others (2017) present an alternative view to Ortman's (2012:181-202) position that there were no dated Late Developmental (AD 900-1200) archaeological sites within the Tewa Basin with Tewa place names based on their own work with Tewa informants. They assert that there were in fact three: (1) LA 835 (Pojaque Grant Site); (2) LA 68 (Nambé Pueblo); (3) LA 57893 (ruin located at uppermost part Nambé Falls). The authors also add that in addition to these three sites, their Tewa informants pointed out Tewa names for two localities associated with site clusters and Late Developmental activity: *Sąwæ˛k'é:* (Sandstone neck) and *P'o: Hu:ˀu* (Water gorge). Finally, Schillaci and others (2017) point out that the earliest dates for sites associated with a Taos place name within the Taos Valley most likely post-date AD 1000 and thus, post-date the Tewa sites within the Tewa Basin. However, given the paucity of Tiwa place names in the current literature, the authors admit that additional research on Tiwa place names is needed to definitively support their conclusion.

Regarding Ortman's (2012:170) assertion of a Proto-Tiwa-Tewa diversification within the Northern Rio Grande, Ware (2016) finds it hard to believe that there could be two large-scale migrations without any significant site-unit intrusions. Ware (2016) references unpublished work by Eric Blinman that posits a Proto-Tiwa-Tewa diversification in the Tewa Basin linked to an earlier (AD 900) northern migration of Proto-Tiwa-Tewa farming communities from the area south of La Bajada (roughly southwest of Santa Fe). In making this argument, Ware (2016) echoes many of the same arguments made in Lakatos (2006, 2007), Boyer and others (2010), Lakatos and Wilson (2012), Lakatos and Post (2012), Wilson (2013), Schillaci and Lakatos (2016, 2017), and Schillaci and others (2017).

The aforementioned scholars argue for cultural continuity in material culture (primarily pithouse architecture and ceramics) as evidence supporting an in-situ development of the Northern Rio Grande cultural complex and subsequent divergence of Proto-Tiwa-Tewa. This position is clearly articulated by Lakatos (2006, 2007) and Lakatos and Wilson's (2012) arguments in favor of cultural continuity in pithouse architecture as well as Schillaci and Lakatos' (2017) arguments for continuity in ceramic tradition based on their re-dating of Kwahe'e Black-on-white production. Finally, the in-situ model is also supported by Boyer and others' (2010) arguments for a larger pre-Early Developmental population within the Middle Rio Grande than is currently accepted based on existing archaeological evidence (based primarily on the ephemeral nature of Early Developmental sites), Wilson's (2013) work on the Chacoan origin of Red Mesa Black-on-white, as well as biological evidence suggesting population flows between populations in the Northern Rio Grande and Chaco Canyon during the Pueblo II period (Schillaci 2003; Schillaci et al. 2001).

To summarize, the Southern Origin hypothesis proposes that Proto-Tiwa-Tewa diversified within the Rio Grande drainage as people migrated from the Middle Rio Grande up into the Northern Rio Grande, and that initial farming communities of the Northern Rio Grande spoke Tewa. Thus, according to the Southern Origin hypothesis, the evidence should support the primacy of Tewa within the Northern Rio Grande. Under the Northern Origin hypothesis these farming communities are thought to have spoken Tiwa, and thus you would expect the evidence to demonstrate Tiwa primacy within the Northern Rio Grande. More specifically, under the Southern Origin hypothesis, the earliest place names for archaeological sites within the Northern Rio Grande should be Tewa, not Tiwa. Furthermore, reconstructed proto-lexicons should support the presence of Proto-Tiwa-Tewa within the Rio Grande.

5.5 Expectations

I have established the following expectations regarding the Southern Origin and Northern Origin hypotheses. If the Northern Origin hypothesis is correct, we should expect the following: (1) historical linguistic data that place a Proto-Tiwa-Tewa diversification outside of the Northern Rio Grande in the vicinity of southwest Colorado prior to the tenth century; (2) historical linguistic data that place Proto-Tiwa speakers in the Northern Rio Grande during the tenth century; (3) references to a 'northern' origin in Tewa and Tiwa oral traditions; (4) limited etymological overlap in Tewa and Tiwa place names; (5) Tiwa place names that pre-date Tewa place names in the Northern Rio Grande.

If the Southern Origin hypothesis is correct, we should expect the following: (1) historical linguistic data that place a Proto-Tiwa-Tewa diversification within the Rio Grande during the tenth century; (2) overlap in Tewa and Tiwa place names in the Middle Rio Grande; (3) references to a 'southern' origin in Tewa and Tiwa oral traditions; (4) Tewa place names that pre-date Tiwa place names in the Northern Rio Grande.

5.6 Assessing the Data

I will begin by assessing the arguments in favor of a PKT homeland on the Colorado Plateau and subsequent presence of a Tanoan dialect chain. Despite critiques of the use of historical linguistics in general (Ware 2016) and Ortman's (2012) proto-lexical reconstructions (Sutton 2014), no one has offered a compelling counter narrative using the entire suite of methodologies. Recent proponents of a Tewa Basin diversification of Proto-Tiwa-Tewa have done one of three things: (1) assumed that any in-migration into the Tewa Basin during the tenth century was comprised of Proto-Tiwa-Tewa speakers (Schillaci and Lakatos 2016, 2017); (2)

acknowledged that the in-situ model inadequately explains modern day Rio Grande Puebloan language distribution (Ware 2016); (3) applied only a component of historical linguistics to the question (Schillaci et al. 2017; Sutton 2014).

However, Shaul (2014:101-107, 2018), who has a PhD in linguistics, confirms Ortman's (2012) hypotheses as to a PKT homeland on the Colorado Plateau and Tanoan dialect model. When referring to Ortman's (2012) work, Shaul (2018:40) states that based on his own reading of the data, "Contact between Tanoan speech communities and speech communities of other languages confirms Ortman's reconstruction of the Tanoan dialect chain" (Shaul 2018). Shaul's (2018:48) distributions of Proto-Tewa and Tiwa speech communities (Figure 5.8) roughly corresponds to Ortman's (2012) model. The primary difference is that Shaul (2014:147-157, 2018:46-48, 88-105) has identified linguistic artifacts within Tanoan languages that are suggestive of contact with both Apachean and Zuni speakers. Based on Ortman's (2012) dating of Tanoan linguistic innovations, Shaul (2018:48) suggests that this contact could have come as early as the tenth century, if not earlier. While intriguing, Shaul (2018:48) admits that a more comprehensive comparison of Proto-Tanoan and Apachean vocabularies is needed.

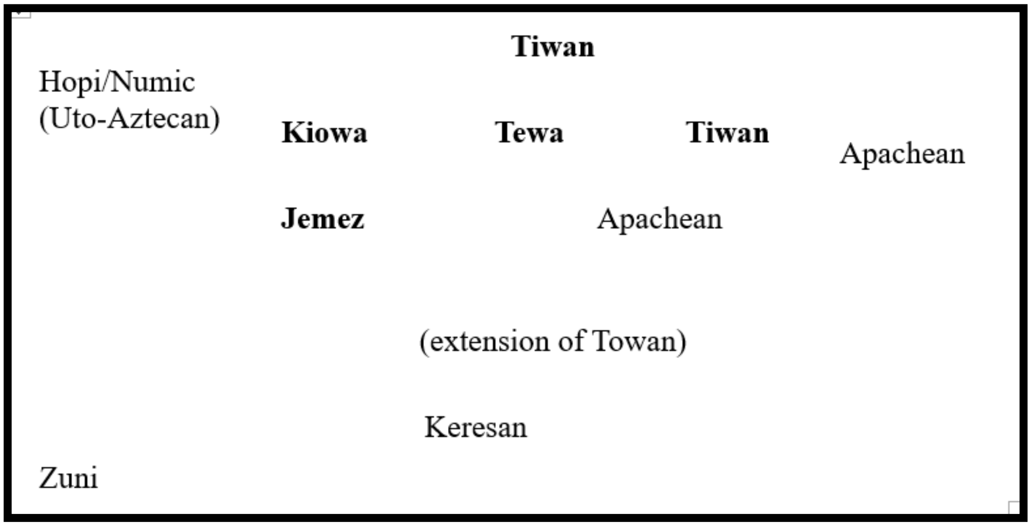

Figure 5.8 Schematic Map of Tanoan Language Distribution Circa AD 900 (Shaul 2018:48)

I would like to add that the linguistic evidence Shaul (2014:147-157, 2018) presents for a possible Tanaoan-Athabaskan connection is fascinating and challenges the long held assertion for a relatively recent entry of Athabaskan speakers into the U.S. Southwest, no earlier than the mid-15th century (Wilshusen 2010). Furthermore, the Upper San Juan sites are located directly in the path of proposed Athabaskan migration routes into the U.S. Southwest, specifically one linked to the Dismal River Culture. Recent archaeological evidence from the Front Range of Colorado also suggests a 14th century (or earlier) arrival of Athabaskan speakers (Gilmore and Larmore 2012). There is also evidence of technology transfer from the Upper Republican Panhandle into Taos in the form of Plains artifacts constructed of non-local material during the 14th century and even earlier evidence of Plains influence on ceramic design in the form of Taos incised gray ware during the tenth century (Fowles 2017).

In addition to confirming Ortman's (2012) PKT homeland and dialect chain hypotheses, Shaul (2018:38-67) also supports Ortman's (2012) identification of particular linguistic innovations indicative of language contact. Most importantly, Shaul (2018) does so using grammatical artifacts (and not just based on phonology), which is no surprise given Shaul's training as a linguist, but it does alleviate concerns regarding Sutton's (2014) critique of Ortman's (2012) methods. Similar to Sutton (2014), Shaul (2018:67) seems to doubt the existence of a Tewa-Tiwa subfamily. While this varies from Ortman's (2012) model, it does not materially affect its overall validity.

Perhaps the most interesting contribution that Shaul (2018) makes related to my own research is his argument for the presence of a Jornada Linguistic Area (Figure 5.9) and associated "Language X" (Shaul 2018:88). Shaul (2018:88) describes the Jornada Linguistic Area as "…the central and lower third of the course of the Rio Grande, extreme southwestern New Mexico, and adjoining northern part of the State of Chihuahua, Mexico. Abutting this area to the northeast is the historic Tiwan area (upper third of the Rio Grande)". Shaul (2018:88) posits that Piro and Tiwa speakers came into contact with speakers of Language X, which was spoken within the Rio Grande before their arrival. Shaul (2018:88-96) points to lacunae in Tanoan cognates where Tiwan is noticeably different than the other lects. Shaul (2018) presents a considerable amount of data supporting the existence of Language X and the influence that its speakers may have had on Tiwa, Piro, Tarahumaran, and Zuni.

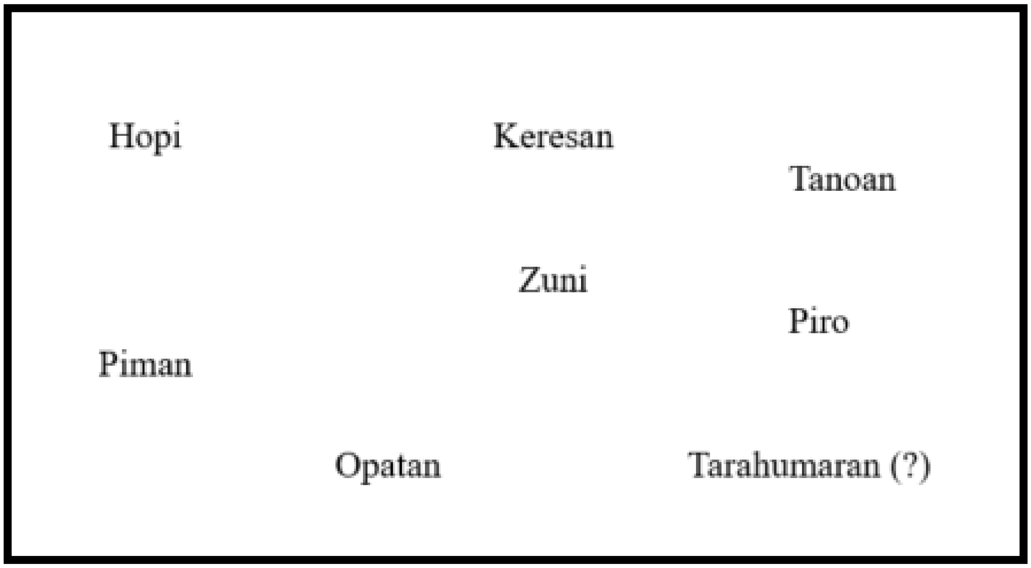

Figure 5.9 Schematic Map of Jornada Linguistic Area (Shaul 2018:101)

Shaul (2018:92) also confirms the presence of a voiceless dental/alveolar lateral fricative, which he calls a “belted-l”. One of several possibilities Shaul (2018) is investigating is that the presence of the belted-l in Tiwan is the result of language contact between Zuni and Tiwan, with Tiwan serving as the TL. This means that Zuni (or a dialect of Zuni) could have been Language X, roughly overlapping with the Mogollon culture area. But, since the belted-l also exists in Apachean, it is conceivable that Apachean speakers could have transmitted it to Zuni speakers. However, Shaul (2018:94) argues that the belted-l is highly integrated linguistically in Zuni (i.e., has a high functional load), which essentially negates that scenario. Additionally, Shaul (2018:94) emphasizes that since established contact between Tanoan speakers and Apachean speakers occurred mostly in Tewa (Shaul 2014:147-158), and the belted-l appears only in Tiwan, the most likely scenario if one was to assume language contact would be one in which Tiwan speakers acquired this sound change from Zuni speakers within the Northern Rio Grande.

A correlation between the Zuni language and the Mogollon culture area has been proposed before, many examples of which can be found in *Zuni Origins: Toward a New*

Synthesis of Southwestern Archeology, edited by Gregory and Wilcox (2007). Within the Rio Grande, the presence of Mogollon brownware and San Marcial Black-on-white clearly demonstrates early cultural contact between the Rio Grande and Mogollon culture areas (Lakatos and Wilson 2012; Tainter and Plog 1994; Wilson 2012b). Thus, while other scenarios for the presence of the belted-l in Tiwa are possible, I believe that the best explanation for the current evidence is one involving contact-induced change.

Oral traditions among Zuni speakers also mention migratory affiliation with places near or within the Rio Grande such as Stone Lions Shrine in Bandelier National Monument (*Shiba:bulima*), the Sandia Mountains (*Chi:biya Yalanne*), the Jemez Mountains (*Kiwaikuluk/a*), and four different names for the Rio Grande (*/iyanik/a:waisha; Yash:tik/u:tu; Mi/ashu:k/awa/ka; K'yawa:na Lana'a or Dekwankwin K'yawa:na Lana)* – although it is not entirely clear from the source what places in the Rio Grande these refer to (Ferguson and Hart 1985:50).

While *Shiba:bulima* is associated with Stone Lions Shrine in Ferguson and Hart (1985:50), Shaul (2018:91) believes the Zuni term is probably derived from the Tiwa term for their own origin place, (Taos: *Cip'opʰuntha*, Isleta: *Ŝip'apʰúnˀai)*, which refers to Sierra Blanca Lake in southern Colorado (Ortman 2012:177). Shaul (2018:89-92) also provides a summary of Zuni ethnohistory and mythology that indicates sharing of ritualistic belief systems between Zuni and Taos. Finally, additional analysis by Shaul (2018:90-105) illustrates a number of lexical artifacts, along with loan words within Zuni, that place Zuni speakers in contact with speakers of Hopi, Piman, Keresan, Opatan, Piro, Tanoan, and possibly even Tarahumaran. According to Shaul (2018:101), "Clearly, Zuni was a language spoken in the Mogollon archaeological culture area, even if Mogollon was a linguistic condominium (the other likely speech community being one with a Keresan variety)".

No evidence has been presented that directly challenges Ortman’s (2012) biodistance analysis (see general criticisms by Boyer and others 2010 and Ware 2016), although previous bioarcheological work on population diversity at Chaco Canyon support some form of population interaction between Chaco Canyon and the Northern Rio Grande during the Pueblo II period (Schillaci et al. 2001; Schillaci 2003). Since migration (and many things related to the human condition) is not a zero-sum game, population flows between both locations is certainly possible.

Regarding Tiwa oral tradition, although Ortman (2012) does not directly address it, summaries of the early literature by both Shaul (2018:48-49) and Fowles (2004:56-122, 2013:87-100) do refer to a northern origin of at least some groups at Taos. Fowles (2013) makes a compelling case for migration of what are known in Taos oral tradition as the ‘Winter People’ from the Piedra District into the Taos Valley in the tenth century. In a later manuscript, Fowles (2017) highlights the ‘rhizomatic’ nature of the founding of Taos, citing references to Apache speaking clans in Taos oral tradition as evidence of its diverse migratory history and suggesting that the ‘Winter People’ may have been Athabaskan speakers from the north and the ‘Summer People’ Tiwa speakers from the south who came together at Taos. The Southern Tiwa village of Isleta also refers to a group that came from the north and another that came up from the south in their oral traditions (Ellis 1979). It is also important to note that terms for the Taos and Isleta place of origin (*Cip’op*^{h}*untha* and *Ŝip’ap*^{h}*únˀai,* respectively*)* are cognate and refer to the same location in the north (Shaul 2018:91). Despite the complex and sometimes contradictory nature of Tiwa oral traditions, we can at least say that there is a deep history of population movement and admixture within the region from multiple source locations.

To conclude, the data suggests the following: (1) Tewa and Tiwa diversified outside of the Northern Rio Grande between AD 920 and 980 most likely in the vicinity of southwest Colorado; (2) Proto-Tiwa reconstructions place Proto-Tiwa speakers in the Northern Rio Grande during the tenth century; (3) Tewa oral tradition references a 'northern' origin, while Tiwa oral tradition is mixed; (4) there is a limited overlap in Tewa and Tiwa place name cognates for locations within the Northern Rio Grande. However, a lack of a comprehensive list of Tiwa pace names makes it very hard to evaluate potential overlap south of the Tewa Basin; (5) we cannot definitively state what language was first spoken in the Northern Rio Grande based on associations of place names with archaeological sites.

Overall, when looking at the entire body of evidence, the Northern Origin hypothesis is the best explanation. While the evidence on oral tradition and place names is mixed, the other lines of evidences argue very much in favor of an external diversification. There has not been a rebuttal to evidence placing Proto-Tiwa speakers in the Northern Rio Grande as early as AD 920. Additionally, there has not been any evidence presented that would contradict the fact that the proto-term for painted turtle is only reconstructible to Proto-Tiwa and not to PKT.

Although Ware (2016) suggests that if the in-situ hypothesis holds, then the greatest overlap in Proto-Tiwa and Tewa cognates for place names should occur south of La Bajada and White Rock Canyon instead of within the Tewa Basin, the lack of a comprehensive list of Tiwa place names hampers our ability to execute this much needed analysis. Despite this unfortunate reality, I can say is that, based on Ortman's (2012) place name comparisons, Tiwa and Tewa place names for Sandia Peak (located south of the Tewa Basin) are not cognates. One would think that if Proto-Tiwa-Tewa speakers migrated up into the Tewa Basin from the Middle Rio Grande and diversified within the Tewa Basin, then the term for such a prominent geographic landmark would be a cognate in the two daughter languages. While a lack of a comprehensive list of Tiwa place names for the Northern Rio Grande makes it difficult to conduct a thorough comparison of Tewa and Tiwa, Ortman (2012:172-181) does state that the Tewa and Tiwa words for Sandia Peak were not cognate, which argues against the Southern Origin hypothesis.

Schillaci and others (2017) do attempt to counter Ortman’s (2012) assertion that there are no Tewa names for Tewa Basin archaeological sites that were abandoned prior to the Late Coalition Period. Their strongest argument is the association of the Tewa place name *K’uuyemugeh* with the Pojoaque Grant site (LA835), which was occupied between AD 910 and 1160 (Schillaci and Lakatos 2017). They based this association on an unpublished sheet map by Mera (Sheet Map #779). However, all other literature associates this name with LA38, including Ellis (1973), Harrington (1919:332), and Ortman (2012:184, 406). Furthermore, the association with LA835 is based on a recent statement from just one Tewa speaker, whereas the existing literature is based on information from many different speakers over a longer period of time. While possible, the preponderance of the literature suggests that *K’uuyemugeh* is most likely not associated with LA835.

Schillaci and others (2017) also propose that the earliest Tiwa place names are those of *P’okut*^{h}*o* (LA12741) and two pithouses (TA-1) under LA260 (Pot Creek Pueblo; *T’aitöna*). Citing work by Fowles (2004:208-232), they initially suggest a Valdez Phase (AD 950/1050-1200) occupation, settling on the AD 1000s as the earliest possible date due to the presence of a small percentage of Red Mesa Black-on-white and a preponderance of Kwahe’e Black-on-white. Their analysis suggests that the initial Tewa presence, as represented by LA835, pre-dates the initial Tiwa presence in the Northern Rio Grande, as represented by LA1274. However, based on Schillaci and Lakatos’ (2017) redating of Kwahe’e Black-on-white and multiple mentions

(Fowles 2004:208-232, 2013:87-93, 2017) of a tenth century Valdez Phase (AD 950-1200) occupation of Taos, one cannot definitively state that there are no Tiwa place names for sites dating to before AD 1000. In addition, Schillaci and others (2017) explain that the Tiwa name for LA12741 lacks morphemic transparency, and that this lack of transparency negates its usefulness. However, others (Campbell 2013:437; Sapir 1949[1916]:436) argue that a lack of morphemic transparency typically signifies that a place name is older than one that can be analyzed into separate morphemes (in fairness, Schillaci and others (2017) do acknowledge this possibility). Thus, an unanalyzable place name such as that of *P'okut^h^o* (LA12741) supports its usefulness as an indicator of early Tiwa occupation.

It is also important to mention that Schillaci and others (2017) and Ortman (2012:182-187) use different assumptions when dating names for archaeological sites. Schillaci and others (2017) assume that the naming occurred at the beginning of the occupation, whereas Ortman takes a more conservative approach in assuming that the name was in place by the time the site was abandoned. As place names can change over time, Ortman's (2012) approach seems like the one less prone to error. If we adhere to Schillaci and others' (2017) assumption, the evidence is certainly not conclusive as to whether Tewa or Tiwa first appeared in the Northern Rio Grande. In addition, there are many more Tewa place names that date to the Coalition Period than the Late Developmental, a trend seemingly at odds with a long-term Tewa presence within the Northern Rio Grande. If we adhere to Ortman's (2012) assumptions, the earliest Tewa presence in the Northern Rio Grande would only date to AD 1350 (Ortman 2016b). This is later than the Tiwa site of LA12741, which dates to the Late Developmental Period (Ortman 2012:185).

Finally, perhaps the most interesting piece of evidence is the presence of the belted-l which may indicate inference through shift via language contact. It is not enough to simply assume that a less than plausible internal development scenario for a particular innovation necessarily implies an external origin is the motivating factor. Rather, one must prove that inference through shift is the best explanation (Thomason 2001). In order to assess the strength of this linguistic artifact as evidence of language contact, I will use the framework outlined in Thomason (2001:93-94).

Thomason's (2001) first criterion is that a particular sound change is not likely to occur in isolation and that there should be other instances of change (phonological, syntactical, etc.). Shaul's (2018) research confirms that this, in fact, does happen in Tiwa. Shaul (2018:72) states that along with the presence of the belted-l (a consonant phoneme), Tiwa demonstrates a suite of changes characteristic of contact with Language X: (1) a loss of phonemic vowel length; (2) full set of personal pronouns used to mark core arguments (versus only using them for emphasis); (3) presence of a unique consonant phoneme (belted-l); (4) a mixed stress-tone system.

Thomason's (2001) second criterion is that a source language must be identified. Shaul (2018:92) has done this by identifying a now vanished dialect of Zuni as most likely Language X. While Language X is a dead language, Zuni is not; thus, comparisons between Tiwa and Zuni can be made. Thomason's (2001) third criterion is that there needs to be shared structural features in the proposed source and receiving languages. The fact that Language X no longer exists makes a direct comparison difficult, but Shaul's (2018:88-89) comparisons with Zuni demonstrate that Zuni and Tiwa share linguistic artifacts representative of the Jornada Linguistic Area such as a full set of personal pronouns and the belted-l. Thomason's (2001) forth criterion is that the receiving language must not have had the shared features before coming into contact with the proposed source language. Ortman (2012:145-147) and Shaul (2018:93-94) have both demonstrated that these innovations were not present in Proto-Tiwa prior to any presumed migration into the Northern Rio Grande.

Thomason's (2001) fifth and final criterion is that the shared features were present in the proposed source language prior to contact with the receiving language. This criterion is a bit harder to meet, as Shaul (2018:72, 94-100) does not explicitly state that sound changes in Zuni representative of membership in the Jornada Linguistic Area were not already present in Zuni. However, Thomason emphasizes that "In many, possibly even most, contact situations around the world, we cannot at present satisfy both the fourth and fifth requirements, and in some cases, we probably never will be able to" (Thomason 2001:94). It would appear then, that the existence of the belted-l in Proto-Tiwa meets all of Thomason's (2001) criteria and can be considered valid evidence in favor of contact-induced change in Tiwa.

Under the Southern Origin hypothesis, the existence of the belted-l would have had to have occurred due to contact between Tiwa speakers and some other language that moved into the Rio Grande drainage after the Proto-Tiwa-Tewa split in the tenth century. Given the scarcity of the belted-l among North American languages and the cultural continuity of the material record in the Rio Grande, the probability that speakers of another, unknown language containing this sound change arrived in the Rio Grande drainage in the tenth century and encountered Tiwa speakers is slim. However, under the Northern Origin hypothesis, Tiwa speakers would have arrived from outside of the Rio Grande drainage, encountering Zuni speakers who already lived there. This scenario provides a much better explanation for the archaeological and linguistic data mentioned above.

CHAPTER 6

CONCLUSION

In this paper, I have evaluated two hypotheses related to the initial settlement of the Northern Rio Grande by ancestral Pueblo people. As a brief recap, the Northern Origin hypothesis refers to the idea that Proto-Tiwa-Tewa diversified outside of the Rio Grande, most likely in the San Juan drainage. The northern narrative is best represented by Ortman (2010, 2012) and Ortman and McNeil (2017). The Southern Origin hypothesis refers to the idea that Proto-Tiwa-Tewa diversified within the Rio Grande drainage, and is best represented by Boyer and others (2010) and Schillaci and Lakatos (2016). Knowing the most likely location for a Proto-Tiwa-Tewa split is critical to the larger, long-standing debate on Tewa ethnogenesis and possible connection to a large thirteenth century population movement out of the Northern San Juan. If Proto-Tiwa-Tewa diversified within the Rio Grande, then this would seriously undermine arguments for a large-scale thirteenth century migration of predominantly Proto-Tewa speakers from the Northern San Juan into the Northern Rio Grande. However, if the opposite is true, then this would bolster such claims.

In Part I of this chapter, I will summarize the results of my analysis of each of the three lines of evidence I have considered. Then, I will evaluate the ability of each hypothesis to explain these results. This comparison should allow for the identification of the hypothesis that provides the most compelling explanation for all three lines of evidence. Finally, I will assess the preferred hypothesis against a series of criteria with the objective of determining if this hypothesis can stand on its own as an explanation. This is perhaps the most crucial step, as establishing the absolute merit of an explanation is the only way to differentiate whether it is truly ‘good’ or if it is simply the least flawed of those considered. I will conclude Part I with some thoughts on directions for future research. In Part II, I will discuss some of the problems that I see in many of the assumptions underlying models on Tanoan language diversification and offer some recommendations for improving such models.

6.1 Population Dynamics

Chapter 3, I followed methodologies established in previous studies (Wilshusen and Wilson 1995; Wilshusen 2002, Varien et al. 2007; Boyer et al. 2010) to estimate momentary population density for the Upper San Juan between AD 800 and 900. In doing so, I focused on a 3,384 km^2 size parcel of land in northwest New Mexico located within what is commonly known as the Fruitland/Navajo Reservoir District.

The results of my analysis indicate that there was most likely a momentary population of around 3,000 people living within my Navajo Reservoir/Fruitland District study area between AD 800 and 900. Looking south of the Tewa Basin to the Middle Rio Grande, Boyer and others (2010) propose a momentary population of 804 people during the same century. Boyer and others (2010) have argued that their estimates are low due to the ephemeral nature of Early Developmental (AD 600-900) sites. In addition, Boyer and others’ (2010) calculations did not include areas outside the Rio Grande such as the Rio San Jose and Puerco of the East Valley, which should all be taken into consideration when evaluating their numbers.

My own analysis of the NMCRIS database demonstrates a 95% decrease in residential site frequency within my study area during the Pueblo II period. Tree-ring data (Potter 2010a; Potter et al. 2012) also support a decrease in construction activity in the Fruitland/Navajo Reservoir District during the Early Pueblo II period. In contrast, data from Boyer and others

(2010) show an increase in population in the Middle Rio Grande, the putative homeland of the Northern Rio Grande population under the Southern Origin hypothesis, during the first part of the Late Developmental period. Finally, based on my analysis of Boyer and others' (2010) settlement data, which includes both intrinsic growth and in-migration, the annual population growth rate of 1.91% for the Northern Rio Grande during the tenth century was higher than the highest intrinsic growth rate ever recorded for the Hawaiian Islands, which is itself one of the highest ever recorded for any human population; this point alone strongly supports substantial in-migration into the Northern Rio Grande in the AD 900s. My own calculations based on juvenility indices revealed an intrinsic growth rate of 0.0066, or roughly 7 people per 1000 per year, for the Middle Rio Grande between AD 800 and 900. While this is at the upper limit for preindustrial societies (Cowgill 1975), it falls well short of the 1.91% annual growth rate required to account for the Late Developmental population of the Northern Rio Grande purely from existing Rio Grande populations.

Overall, these data suggest that the Middle Rio Grande population: (1) was too small to serve as the primary driver of Northern Rio Grande population increases; (2) did not have an intrinsic growth rate high enough to generate the people who settled in the Northern Rio Grande; (3) exhibits no evidence of decrease after AD 900 that would be indicative of a large exodus of people into the Northern Rio Grande. This analysis also demonstrated that the Upper San Juan: (1) appears to have had enough people during the late Pueblo I/early Pueblo II period to serve as a potential source area for tenth century Northern Rio Grande migration; and (2) suffered the expected population decrease associated with large-scale population movement.

6.2 Material Culture

Chapter 4, I examined the two competing hypotheses from the perspectives of pithouse architecture and ceramic traditions. Continuity in pithouse architecture between Middle and Northern Rio Grande communities during the Developmental period (AD 600-1200) has previously been cited (Boyer et al. 2010; Lakatos 2006, 2007; Lakatos and Wilson 2012) as strong support for in-situ cultural development and against migration from the Northern San Juan in the development of Rio Grande Pueblo societies. Arguments have centered on putative differences between Northern Rio Grande pithouses and those located in the San Juan drainage (Lakatos 2006, 2007). Specifically, attributes such as room shape, four primary roof posts, separate ventilator shaft, above floor vent tunnels, east-to-southeast orientation and adobe collared hearths were considered typical of Early Developmental period pithouses, and these tended to remain constant into the Late Developmental period as well, while these attributes are rare to nonexistent in Northern San Juan pithouses of the same period (Lakatos and Wilson 2012). However, my own research has shown that Lakatos' (2006) study claimed to characterize the entire 'San Juan' when in fact it focused on the Northern San Juan and San Juan Basin, and did not consider the Upper San Juan separately. As such, I identified this as a gap in knowledge that I could fill with my own research.

The results of my analysis of material culture suggest that late Pueblo I Upper San Juan pithouses are more similar to tenth century Northern Rio Grande pithouses than they are to Northern San Juan pithouses. There are no statistical differences in the use of four primary roof posts, separate vent shafts, above-floor vent openings, deflectors, hearths with adobe collars, sipapus, wall niches, and east/southeast orientation. Where significant differences do exist, they are primarily due to the presence of additional, apparently innovative traits in later pithouses of the Northern Rio Grande (non-circular pithouses, D-shaped hearths, etc.). It should be said, however, that a few Upper San Juan pithouse traits, such as partial benches and bifurcated ventilators, do not occur in Northern Rio Grande pithouses. It would be interesting to chart the spatial and temporal distributions of these features more broadly.

Ceramic trends in the Upper San Juan, Middle Rio Grande, and Northern Rio Grande are quite distinct. In the Upper San Juan, Piedra Phase (AD 850-950) assemblages generally contained ceramics with mineral paint and crushed igneous rock temper as opposed to glaze paint and sand and/or crushed quartzite temper (Chuipka 2008; but see Simpson 2016). Utility ware typically comprised at least 80% of the total assemblage, the most frequent being plain gray ware followed by neckbanded gray ware. The predominant decorated ware was mineral painted Piedra Black-on-white followed by Bancos Black-on-white (Eddy 1966; Sesler and Hovezak 2002; Wilshusen 1999). Red Mesa Black-on-white and Cortez Black-on-white first appeared in assemblages from Navajo Reservoir during the Piedra phase (Eddy 1966). Arboles Phase (AD 950-1050) ceramics essentially continued Piedra phase trends, with the continued production of plain gray ware (Arboles gray), neckbanded gray ware (Arboles neckbanded), Cortez Black-on-white, and Red Mesa Black-on-white with reduced frequencies of Piedra Black-on-white and Bancos Black-on-white (Eddy 1966).

Early Developmental (AD 600-900) ceramic assemblages in the Rio Grande contained 90% coarse sand tempered plain gray ware. The predominant decorated ware was San Marcial Black-on-white, the production of which is considered to reflect Mogollon influences in terms of pattern designs as well as the use of red paint on top of a white-slipped, brown clay body. Early Developmental Rio Grande assemblages also contain Mogollon brown ware and unpainted red ware. Notable shifts occurred in the Late Developmental period (AD 900-1200) with the appearance of neckbanded gray ware and the replacement of San Marcial Black-on-white with Red Mesa Black-on-white (Lakatos and Wilson 2012). Importantly, ceramic assemblages in the Mogollon area changed in different ways after AD 900. Thus, it appears that Rio Grande ceramic assemblages changed in ways that betray increasing interaction with the San Juan drainage, including the Upper San Juan, and less interaction with the Mogollon area, starting around AD 900.

Overall, these data suggest the following: (1) Upper San Juan pithouses exhibit most of the typical Northern Rio Grande pithouse traits; (2) There is more continuity in ceramic traditions between pre-AD 900 Upper San Juan sites and tenth century Northern Rio Grande sites than there is between pre-AD Middle Rio Grande sites and tenth century Northern Rio Grande sites. Given these patterns, I argue that, while these data do not exclude either the Southern Origin or Northern Origin hypothesis, they certainly do not exclude the Upper San Juan from consideration.

6.3 Linguistic Paleontology

Finally, in Chapter 5, I summarized previous work by Ortman (2012) and Shaul (2014, 2018) on Tanoan languages, specifically data pertaining to Proto-Tiwa-Tewa diversification. I initially looked at the question of a Proto-Kiowa-Tanoan homeland and highlighted two separate studies (Ortman 2012; Shaul 2014, 2018) that used proto-lexicon reconstructions to argue that the most likely location was in the northern U.S. Southwest, especially the Colorado Plateau of southwest Colorado, southeast Utah, and northwest New Mexico.

I then looked at the question of the separation of Proto-Tiwa-Tewa, highlighting the lack of shared phonetic innovations between Proto-Tewa and Proto-Tiwa which suggests a quick separation of the ancestral speech communities at some point in their formation (Ortman 2012). Additional evidence for the date of separation of Proto-Tiwa speakers from Tewa speakers relates to the identification of reconstructed terms in Proto-Tiwa-Tewa for items such as ‘string’, ‘squash’, ‘cooking pot’, and ‘olla’ that first appear in the archaeological record around AD 725 and as late as AD 920. As such, AD 920 serves as the upper limit for the existence of a single Proto-Tiwa-Tewa lect.

Next, I identified a unique sound change noted by Ortman (2012) as occurring only in Proto-Tiwa, which can be described as a change from a voiced alveolar fricative /s/ to a voiceless dental/alveolar lateral fricative /ɬ/. The presence of a voiceless dental/alveolar fricative is considered rare among the world’s languages, but does exist in the U.S. Southwest among Tiwa, Zuni, and Apachean speakers (Shaul 2018). I assessed the likelihood that such a sound change was due to language contact by applying a framework developed by Thomason (2001:93-94), and concluded that it was highly likely that language contact occurred and caused this sound change. I believe that the best explanation for the existing archaeological (Clark 2007; Tainer and Plog 1994) and linguistic evidence (Shaul 2018:88-96) is that Tiwa speakers came into contact with Early Developmental populations of the Rio Grande drainage who spoke a dialect of Zuni.

The dating of items reconstructible only to Proto-Tiwa that were associated with the rise of Chaco canyon, such as ‘viga’ and ‘macaw’, indicate that Proto-Tiwa speakers were in the Northern Rio Grande by no later than AD 980. Another line of evidence to support this assertion is the presence of what appears to be a loan word for ‘turquoise’ from Keres, which Ortman (2012:166) and Shaul (2014:110) argue was the primary language at Chaco, in Proto-Tiwa, but not Proto-Tewa. Additionally, the proto-term for painted turtle is only reconstructible to Proto-

Tiwa and not to Proto-Tiwa-Tewa or Proto-Tanoan (Ortman and McNeil 2017). This is significant because turtle remains are common in Northern Rio Grande faunal assemblages but they have not been found in any sites in southwestern Colorado, the Totah region, or Chaco Canyon. The most plausible scenario then is that Tanoan-speaking groups independently encountered and named this species upon their arrival in the Northern Rio Grande. Also, the fact that terms for turtle are cognate in Northern and Southern Tiwa suggests that, unlike other Tanoan lects, the Tiwa languages diversified after their arrival in the Rio Grande drainage.

I also compared competing arguments for the diversification of Proto-Tiwa-Tewa based on toponyms. Ortman (2012:181-184) argues that there were no Tewa place names for Tewa Basin archaeological sites prior to AD 1200, and that a general lack of overlap in cognates for Northern Rio Grande place names between Proto-Tewa and Proto-Tiwa is evidence for a Proto-Tiwa-Tewa diversification outside of the Northern Rio Grande. However, Schillaci and others (2017) propose several Tewa names for archaeological that date to the tenth century, although their association is highly disputed. Ware (2016) believes that a lack of place name cognates within the Northern Rio Grande is not surprising given that the Southern Origin hypothesis would view the area south of the Tewa Basin as the most likely location for such overlap.

Although I was unable to conduct an in-depth comparison of Tewa and Tiwa place names in the Middle Rio Grande due to a dearth of quality data on Tiwa place names, I did reference Ortman's (2012:Table 8.1) list of place names to select a place name in the Middle Rio Grande that would serve as a quick test of Ware's (2016) hypothesis. I selected Sandia Peak, as it was the only place name located south of the Tewa Basin. If Proto-Tiwa-Tewa speakers migrated through this area on their way into the Northern Rio Grande, then the term should have cognates in Tewa and Tiwa. Instead, Ortman's (2012:179) analysis demonstrated that the terms for Sandia

Peak in Tewa and Tiwa are not related. In fact, neither were the Southern Tiwa (Isleta) and Northern Tiwa (Taos) forms.

In presenting their argument for Proto-Tiwa-Tewa diversification, Schillaci and others (2017) assert that there are no Tiwa place names associated with sites that date prior to AD 1000, but Fowles' (2004, 2013) dating of Taos Valley archaeological sites appears to contradict them. Tiwa oral traditions also generally refer to a northern migration, although evidence for that is mixed (Fowles 2004, 2013, 2017; Shaul 2018). There is also a substantial amount of Tewa oral tradition that references a northern origin (Ortman 2012:187-202).

To conclude, these data suggests the following: (1) Tewa and Proto-Tiwa diversified outside the Rio Grande drainage between AD 920 and 980; (2) reconstructed vocabulary suggests Proto-Tiwa speakers were located in the Northern Rio Grande during the tenth century; (3) Tiwa oral tradition suggests a mixed origin, with references to both north and south of current community locations; (4) limited data suggests Proto-Tiwa speakers did not migrate up from the Middle Rio Grande; (5) the majority of the data points to Tiwa primacy in the Northern Rio Grande. Whether Tiwa preceded Tewa in the Middle Rio Grande, or indeed, whether Tewa was ever spoken in the Middle Rio Grande, cannot be definitively established based on current data. In the concluding chapter, I provide an overall evaluation of the Northern Origin and Southern Origin hypotheses and consider the extent to which the preferred hypothesis can stand on its own as a good explanation of where the initial farming population of the Northern Rio Grande came from.

CHAPTER 7

BRINGING IT ALL TOGETHER

7.1 Discussion of Results

Clearly, elements of the evidence I have compiled for this study can be interpreted as both supporting and contradicting the same hypothesis. For example, while there are general similarities in pithouse architecture between both subregions, one might argue that a lack of partial benches, bifurcated ventilators, and adobe rimmed mealing bins in Northern Rio Grande pithouses is a line of evidence against migration from the Upper San Juan. However, the Northern Origin hypothesis does not view a lack of a certain trait or set of traits as evidence against migration – it clearly provides for such a scenario. The migratory framework it adheres to allows for a nuanced expression of migration, one that rejects essentialist frameworks and a priori expectations and allows for the expression or suppression of material culture depending on unique socio-cultural contexts linked to population movement.

However, as I stated before, migratory frameworks are not created in a vacuum, and all are influenced by archaeological prejudgments. Northern Origin proponents believe that cultural, linguistic, and perhaps even ethnic differences existed between the Northern San Juan and the Upper San Juan and that these differences might have been linked to the Upper San Juan’s rejection of all things Chaco. Based on these prejudgments, Northern Origin proponents would expect cultural continuity of some sort in the material record. And, in fact, that is just what we see in the pithouse architecture data.

Southern Origin proponents would expect clear site-unit intrusions, as dictated by their own prejudgments which view the Northern and Upper San Juan as culturally homogeneous and distinct from that of the Northern Rio Grande. However, this I have shown this to be false, and that the reality is that the pithouse architecture of the Upper San Juan is more like that of the Northern Rio Grande than that of the Northern San Juan. This parallel in pithouse architecture was noted earlier by Wendorf (1954) and Wendorf and Reed (1955) but has been overlooked in the recent literature.

What we do see in the Northern Rio Grande archaeological record is the appearance of sites associated with Red Mesa Black-on-white and neckbanded gray ware, which was produced throughout the San Juan drainage from roughly the mid-ninth century to the early-tenth century. Despite its categorization by many researchers as part of the Chaco and Cibola tradition, very similar styles have been found in both the Northern San Juan (Cortez Black-on-white, Moccasin and Mancos Gray) and Upper San Juan (Cortez Black-on-white and Arboles Black-on-white, Moccasin and Mancos Gray, etc.). The appearance of these ceramic traditions has previously been associated with migratory streams from both the Northern San Juan (Wilshusen and Van Dyke 2006) and the Upper San Juan (Fowles 2004, 2013). Interestingly, Southern Origin proponents assume that the appearance of these ceramic types was the result of migration from the Chaco-Cibola region, trade, or local production, and do not consider the possibility of migration from the Upper San Juan. As I understand it, their argument entails people first migrating from the Northern San Juan into Chaco, and then from Chaco into the Northern Rio Grande.

Or, perhaps the Southern Origin assumption is that the appearance of Red Mesa Black-on-white truly was a pan-Puebloan phenomenon reflecting a ninth century horizon style. Either way, scholars note that that the appearance of Red Mesa Black-on-white is still not very well understood (McNutt 1969; Wilson 2012c; Washburn 2013). I would argue that this is true only if you ascribe to the Southern Origin hypothesis; from the perspective of the Northern Origin hypothesis this makes perfect sense as a piece of the overall narrative.

The Northern Origin hypothesis provides the best explanation for the existing population evidence as well, despite arguments suggesting that Developmental Middle Rio Grande population numbers are underestimated (Boyer et al. 2010). It is unlikely that there are enough undiscovered sites to change the population history of the Middle Rio Grande such that in-migration is not required to achieve the observed growth rates. Furthermore, if there indeed was a migration from the Middle Rio Grande into the Northern Rio Grande, one would expect a decline in Middle Rio Grande population. Again, this is not what the data show.

Finally, I find the Northern Origin hypothesis to be the only viable explanation for the majority of the evidence from linguistic paleontology. No one has proposed an alternative explanation for Ortman's (2012) and Shaul's (2014, 2018) Proto-Kiowa-Tanoan homeland construction, Ortman's (2012) historical linguistic results, or his 'words and things' analysis of Proto-Tiwa loan words. Sutton's (2014) argument that the belted-l is internally generated seems lackluster, as even he admits that the presence of such a unique sound change is difficult to reconstruct as a result of internal language processes.

Although the evidence derived from place name analysis and oral tradition is contradictory at times, it is only one part of a spectrum of linguistic evidence brought to bear on the question. Furthermore, Shaul's (2018) hypothesis of a Jornada Linguistic area in which Language X was spoken dovetails quite well with archaeological literature linking the Mogollon culture area with the Zuni language (Clark 2007). Finally, the archaeological record of the early Rio Grande clearly demonstrates a certain amount of hybridism indicative of Ancestral Puebloan and Mogollon cultural contact (Lakatos and Wilson 2012; Tainter and Plog 1994).

Overall, I argue that the Northern Origin hypothesis provides the most compelling explanation for the population and linguistic data. While there are still questions about how best to interpret the material culture evidence, the Northern Origin hypothesis can certainly accommodate the pithouse and ceramic evidence into its narrative. In contrast, the Southern Origin hypothesis cannot incorporate the demographic and linguistic evidence, it can only provide an explanation for a single line of evidence which does not generate a coherent narrative and thus is the weaker of the two hypotheses.

7.2 Evaluating the Northern Origin Hypothesis

As a last step, I will apply Fogelin's (2007) criteria to the Northern Origin hypothesis to evaluate whether or not it can stand on its own as an adequate explanation. While it may be unrealistic to expect any explanation to meet all the below criteria, it should be able adequately fulfill most of them. Table 7.1 lists these criteria along with my conclusions regarding the ability of the Northern Origin hypothesis to meet them.

Table 7.1 Evaluation Criteria as Applied to the Northern Origin Hypothesis

Criteria	Definition	Result
Empirical Breadth	Does the best explanation address multiple lines of evidence?	Yes, it addresses three – material culture, population dynamics, and language.
Generality	Is the explanation applicable to a wide variety of phenomena?	Yes, this framework can be applied to any archaeological context in which migration is assumed to have occurred.
Refutability	Can you refute this explanation? Would you know if you were wrong?	Yes, this explanation could be refuted by the inclusion of additional source and target population estimates, a comprehensive list of Tiwa place names, and/or contradictory historical linguistic evidence on PKT homelands.
Conservatism	Does the explanation reject well-founded explanations or principals without just cause?	No, while it does reject simplistic 'absence/presence' migratory models, I do not believe this is an unfounded rejection.
Simplicity	Does the explanation create complicated laws or principals that are not needed?	No, while it does apply a more nuanced concept of migration, such a nuanced perspective has been shown to be a much better fit for adequately investigating migration in the archaeological record.
Multiplicity of Foils	Can the explanation account for multiple foils? In other words, can it account for counterarguments to its own explanations?	Mostly. The Northern Origin hypothesis adequately addresses many of the counter-explanations presented by the Southern Origin hypothesis for categories of evidence such as population growth and material culture. The question of NRG place names is problematic.

Note: Table adapted from Fogelin (2007:618-620)

While certainly not perfect, I would argue that the above analysis supports the value of the Northern Origin hypothesis as an explanation of Proto-Tiwa-Tewa origins and is more than capable of standing on its own two feet.

7.3 Directions for Future Research

Applying a multi-disciplinary approach to the question of Proto-Tiwa-Tewa language diversification in the context of a potential Upper San Juan to Northern Rio Grande migration has been a massive, but very rewarding endeavor. Migration is a complex socio-cultural phenomenon that requires a complex framework of analysis. It is certainly not easy, and I see why multi-disciplinary studies of migration such as those by Ortman (2012), Shaul (2014) and Beekman and Christensen (2003) are few and far between. While I hope to have made a contribution towards understanding of the initial settlement of the Northern Rio Grande, there are certainly lacunae where additional information would make a meaningful impact.

For example, a more substantive list of Tiwa place names would allow for a more detailed comparison of Tewa and Tiwa place names. Correlative population studies from more subregions across the Southwest would also help evaluate claims of an Upper San Juan-Northern Rio Grande migration. Contrastive explanations for a PKT homeland would be welcome as well, as none currently exist for comparison with current research. Finally, ceramic sourcing studies of Red Mesa Black-on-white would help to clarify our understanding of both the production and consumption of this widespread ceramic type.

Overall, I conclude that the Southern Origin hypothesis fails to provide the most compelling narrative for the origin of the initial farming population of the Northern Rio Grande. The evidence I have presented makes a strong case that the Tiwa and Tewa languages originated in the San Juan drainage, that the two languages became isolated from each other in the tenth century, and that Tiwa speakers were likely located in the Northern Rio Grande by the end of that century. In addition, based on the current data, the Middle Rio Grande lacks the growth rates and population outflows one would expect for a potential source area for the initial Pueblo population of the Northern Rio Grande. Finally, at the very least, both population dynamics and material culture continuities do not rule out the Upper San Juan as a potential source area.

7.4 The Northern Origin Hypothesis: Concluding Thoughts

We have seen that migratory frameworks are not created in isolation. Instead, they are shaped by the prejudgments that archaeologists bring to every research question. In the case of the Northern Origin hypothesis, prejudgments derive from previous work on possible linguistic and/or ethnic divisions between the Northern San Juan and Upper San Juan. (Chuipka and Hovezak 2008; Hovezak and Sesler 2002a; Ortman 2012; Potter 2010a; Wilshusen 1999; Wilshusen and Ortman 1999). If we combine Fowles' (2013) description of the material culture of the Piedra District as distinctly 'anti-Chaco' with comments on the anachronistic nature of Upper San Juan ceramic assemblages and distinctive circular pithouse morphology (Hovezak and Sesler 2002a), an interesting social-cultural juxtaposition begins to take shape.

Differences in settlement layout between McPhee Village and Grass Mesa Village appear to be a microcosm of macro socio-cultural differences in settlement patterns between mid-to-late Pueblo I villages to the west of the La Plata River and mid-to-late Pueblo I villages to the east of the La Plata River. Specifically, settlements in both Cedar Hill and Navajo Reservoir adhere much more closely to architectural patterns seen at Grass Mesa Village and others on the east side of the Dolores River Valley than McPhee Village and other settlements to the west. The former are more dispersed, tend to be organized around a Great Kiva, and contain more round, culturally conservative pithouses than villages west of the river, which some (Windes 2015:720) consider to be proto-Great Houses, the first seeds of what is to become the 'Chaco Phenomenon'. In fact, in terms of settlement layout, pithouse architecture, and ceramic traditions, late Pueblo I communities of the Upper San Juan have more in common with tenth century Northern Rio Grande communities than with late Pueblo I Northern San Juan communities.

I argue that the evidence demonstrates the presence of a clear cultural divide roughly paralleling the La Plata River, in which the western faction heard the siren's song emanating from the incipient epicenter of the Pueblo world, while the eastern faction retreated to the Northern Rio Grande, an area that represented the antithesis of Chaco. This narrative would be consistent with a scenario in which the existence of two separate migratory streams was correlated with the presence of at least two separate cultural/ethnic groups. In this scenario, those living west of the La Plata River saw late Pueblo I/early Pueblo II Chacoan communities as an opportunity to reestablish the hierarchical social organization that was incipient at McPhee village, while those east of the La Plata River preferred to maintain their own conservative cultural traditions. In this case, the culturally conservative, 'anti-Chaco' nature of Northern Rio Grande culture would be a far more appealing destination than one on the verge of developing into the Southwestern equivalent of an early ranked society.

While I acknowledge that there is still much work to be done, I hope that my research makes a small contribution to the larger debate on Rio Grande population movements and serves as an example of the value of applying a multi-disciplinary framework to the study of migration, inspiring more archaeologists to embrace such a perspective in the future.

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APPENDIX

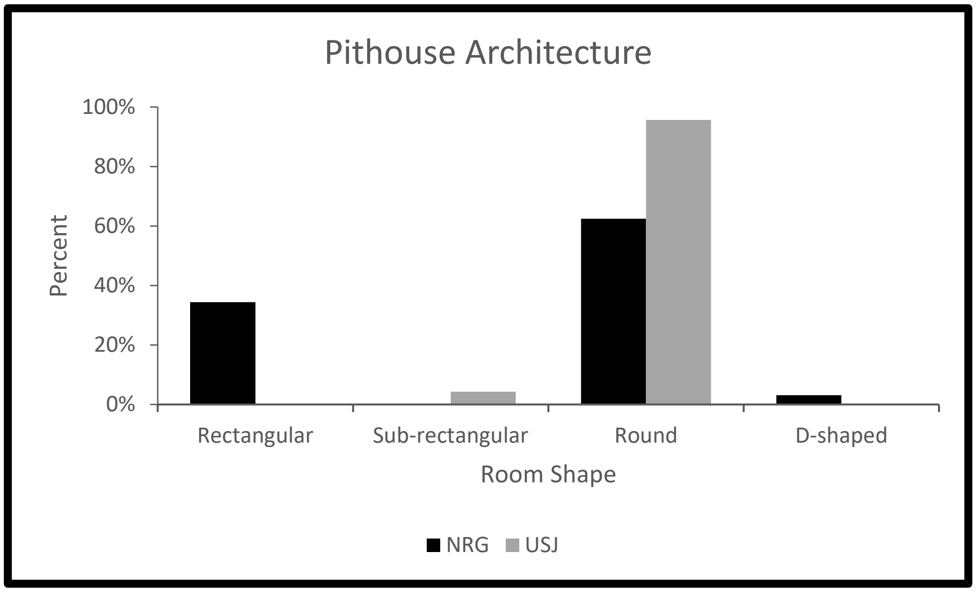


Figure A.1 Room Shape Frequencies

Freq: Frequency

Contingency Table

Room Shape

Subregion	Count / Expected	Other	Round	Total
NRG	12	12	20	32
		7.56364	24.4364	
USJ		1	22	23
		5.43636	17.5636	
Total		13	42	55

Tests

N	DF	-LogLike	RSquare (U)
55	1	4.7934030	0.1594

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	9.587	0.0020*
Pearson	8.148	0.0043*

Fisher's Exact Test	Prob	Alternative Hypothesis
Left	0.9998	Prob(Room Shape=Round) is greater for Subregion=NRG than USJ
Right	0.0038*	Prob(Room Shape=Round) is greater for Subregion=USJ than NRG
2-Tail	0.0043*	Prob(Room Shape=Round) is different across Subregion

Figure A.2 Room Shape Chi Squared

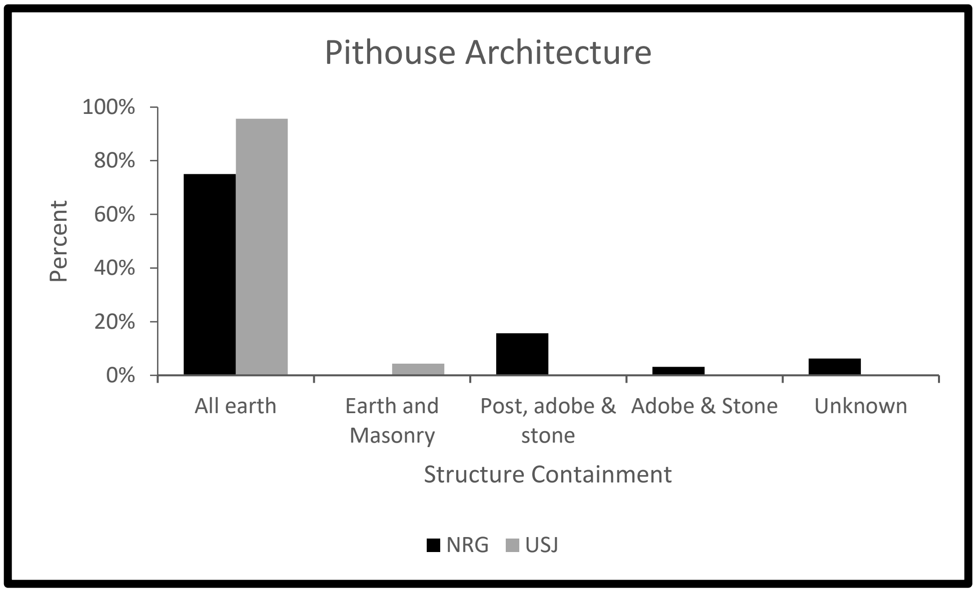


Figure A.3 Structure Containment Frequencies

Freq: Frequency

Contingency Table

Structure containment (all earth)

Subregion	Count / Expected	Absent	Present	Total
NRG	Count	8	24	32
	Expected	5.23636	26.7636	
USJ	Count	1	22	23
	Expected	3.76364	19.2364	
	Total	9	46	55

Tests

N	DF	-LogLike	RSquare (U)
55	1	2.4026421	0.0980

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	4.805	0.0284*
Pearson	4.170	0.0411*

Fisher's Exact Test	Prob	Alternative Hypothesis
Left	0.9956	Prob(Structure containment (all earth)=Present) is greater for Subregion=NRG than USJ
Right	0.0425*	Prob(Structure containment (all earth)=Present) is greater for Subregion=USJ than NRG
2-Tail	0.0642	Prob(Structure containment (all earth)=Present) is different across Subregion

Figure A.4 Structure Containment Chi Squared

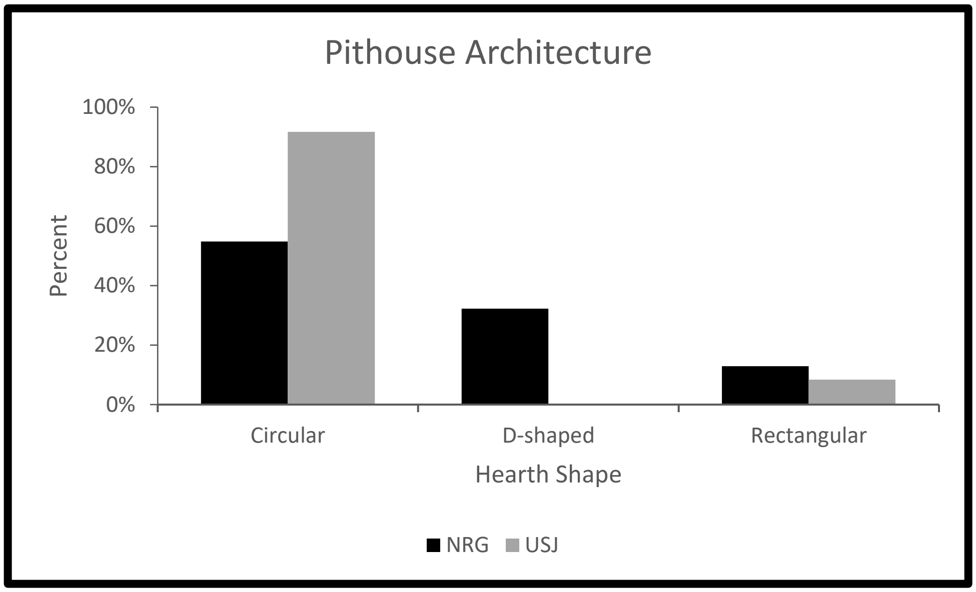


Figure A.5 Hearth Shape Frequencies

Freq: Frequency

Contingency Table

Hearth Shape

Subregion	Count Expected	Circular	Not circular	Total
	NRG	17 22.1091	15 9.89091	32
	USJ	21 15.8909	2 7.10909	23
	Total	38	17	55

Tests

N	DF	-LogLike	RSquare (U)
55	1	5.0971538	0.1499

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	10.194	0.0014*
Pearson	9.134	0.0025*

Fisher's Exact Test	Prob	Alternative Hypothesis
Left	0.0023*	Prob(Hearth Shape=Not circular) is greater for Subregion=NRG than USJ
Right	0.9998	Prob(Hearth Shape=Not circular) is greater for Subregion=USJ than NRG
2-Tail	0.0030*	Prob(Hearth Shape=Not circular) is different across Subregion

Figure A.6 Hearth Shape Chi Squared

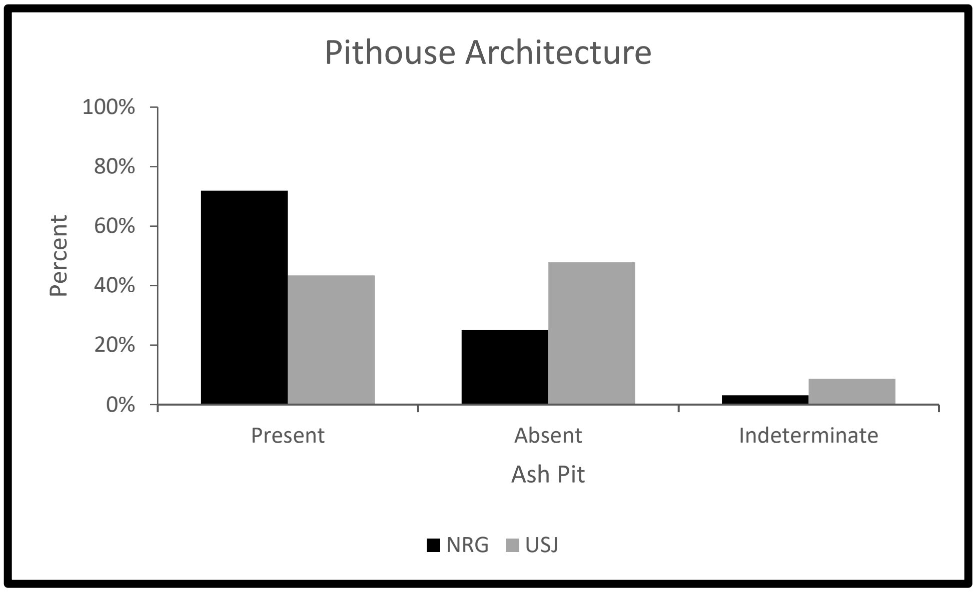


Figure A.7 Ash Pit Frequencies

Freq: Frequency

Contingency Table

Ash Pit

Subregion	Count / Expected	Absent	Present	Total
NRG	Count	9	23	32
	Expected	12.8	19.2	
USJ	Count	13	10	23
	Expected	9.2	13.8	
Total		22	33	55

Tests

N	DF	-LogLike	RSquare (U)
55	1	2.2573066	0.0610

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	4.515	0.0336*
Pearson	4.496	0.0340*

Fisher's Exact Test	Prob	Alternative Hypothesis
Left	0.0327*	Prob(Ash Pit=Present) is greater for Subregion=NRG than USJ
Right	0.9919	Prob(Ash Pit=Present) is greater for Subregion=USJ than NRG
2-Tail	0.0511	Prob(Ash Pit=Present) is different across Subregion

Figure A.8 Ash Pit Chi Squared

req: Frequency

Contingency Table

Enclosed Space (m2)

Subregion	Count / Expected	Greater than 28.5m2	Less than or equal to 28.5m2	Total
	NRG	4	14	18
		9.27273	8.72727	
	USJ	13	2	15
		7.72727	7.27273	
	Total	17	16	33

Tests

N	DF	-LogLike	RSquare (U)
33	1	7.4338745	0.3252

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	14.868	0.0001*
Pearson	13.604	0.0002*

Fisher's Exact Test	Prob	Alternative Hypothesis
Left	0.0003*	Prob(Enclosed Space (m2)=Less than or equal to 28.5m2) is greater for Subregion=NRG than USJ
Right	1.0000	Prob(Enclosed Space (m2)=Less than or equal to 28.5m2) is greater for Subregion=USJ than NRG
2-Tail	0.0004*	Prob(Enclosed Space (m2)=Less than or equal to 28.5m2) is different across Subregion

Figure A.9 Enclosed Space Chi Squared

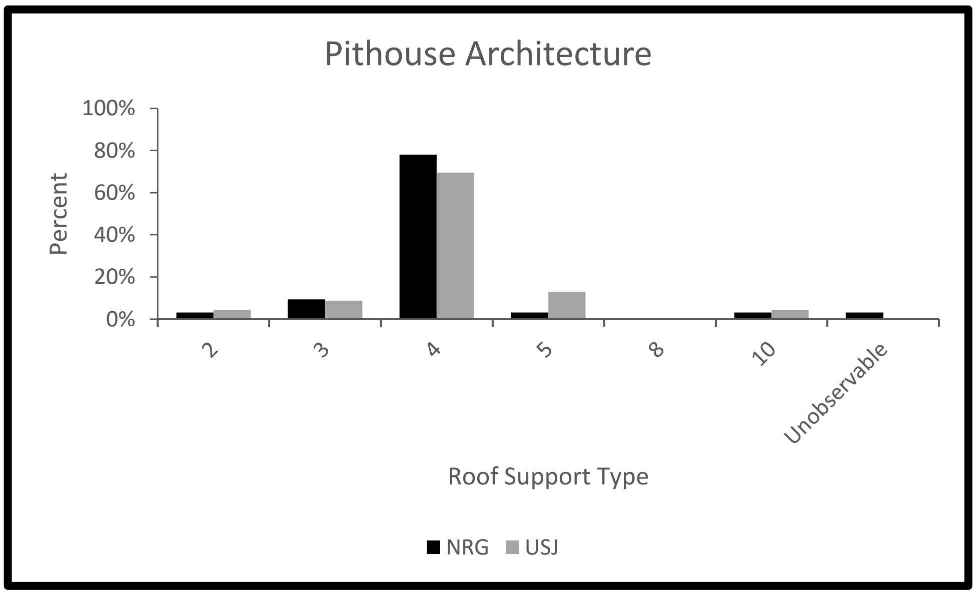
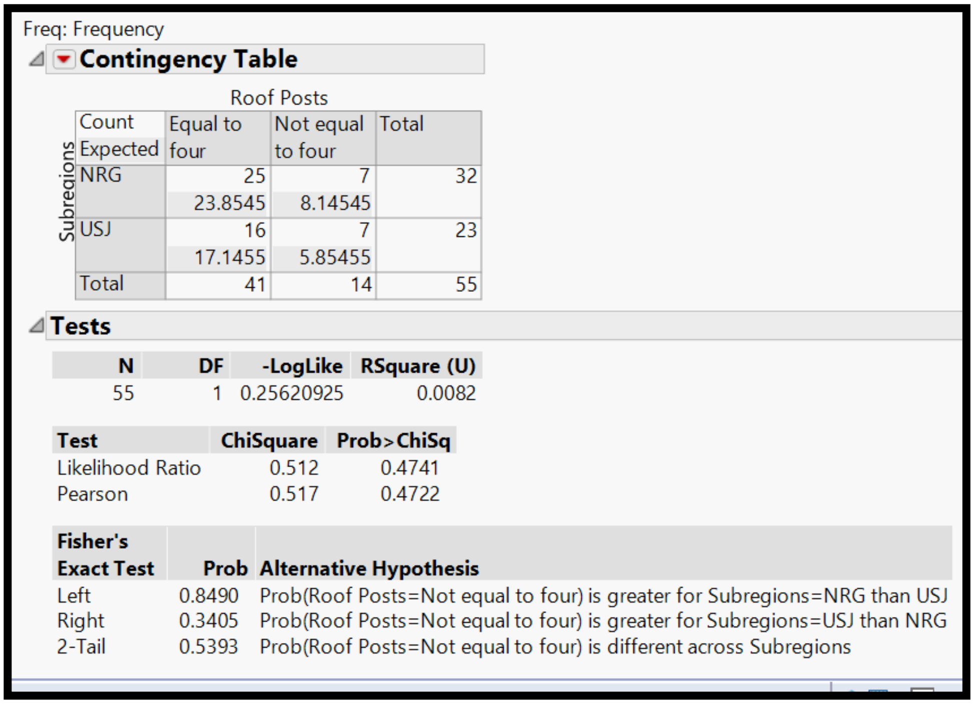


Figure A.10 Roof Support Type Frequencies



Freq: Frequency

Contingency Table

Roof Posts

Subregions: Count / Expected	Equal to four	Not equal to four	Total
NRG	25	7	32
	23.8545	8.14545	
USJ	16	7	23
	17.1455	5.85455	
Total	41	14	55

Tests

N	DF	-LogLike	RSquare (U)
55	1	0.25620925	0.0082

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	0.512	0.4741
Pearson	0.517	0.4722

Fisher's Exact Test	Prob	Alternative Hypothesis
Left	0.8490	Prob(Roof Posts=Not equal to four) is greater for Subregions=NRG than USJ
Right	0.3405	Prob(Roof Posts=Not equal to four) is greater for Subregions=USJ than NRG
2-Tail	0.5393	Prob(Roof Posts=Not equal to four) is different across Subregions

Figure A.11 Roof Posts Chi Squared

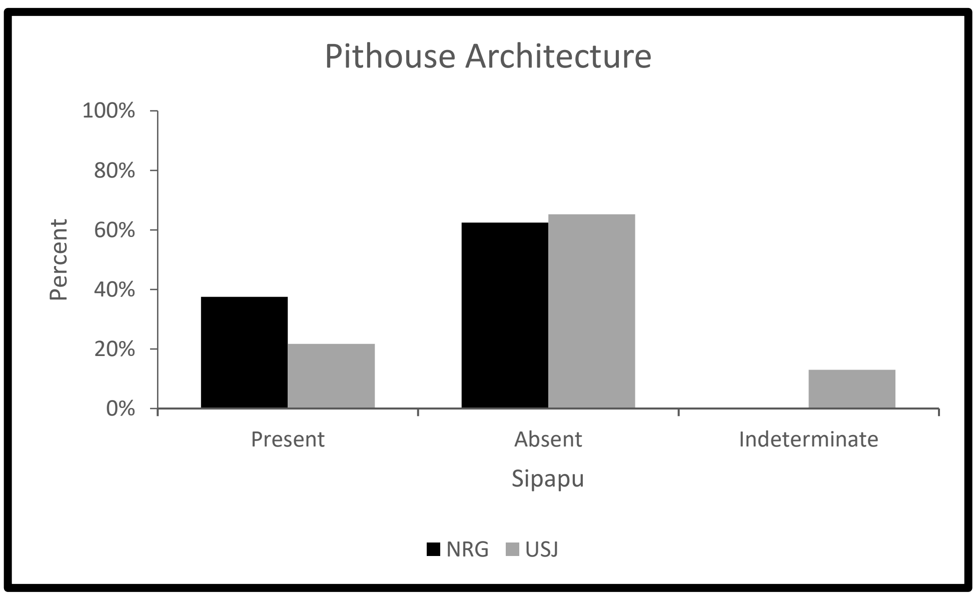


Figure A.12 Sipapu Frequencies

Freq: Frequency

Contingency Table

Subregion / Sipapu (Count, Expected)	Absent	Present	Total
NRG	20	12	32
	20.3636	11.6364	
USJ	15	8	23
	14.6364	8.36364	
Total	35	20	55

Tests

N	DF	-LogLike	RSquare (U)
55	1	0.02139233	0.0006

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	0.043	0.8361
Pearson	0.043	0.8363

Fisher's Exact Test	Prob	Alternative Hypothesis
Left	0.5325	Prob(Sipapu=Present) is greater for Subregion=NRG than USJ
Right	0.6867	Prob(Sipapu=Present) is greater for Subregion=USJ than NRG
2-Tail	1.0000	Prob(Sipapu=Present) is different across Subregion

Figure A.13 Sipapu Chi Squared

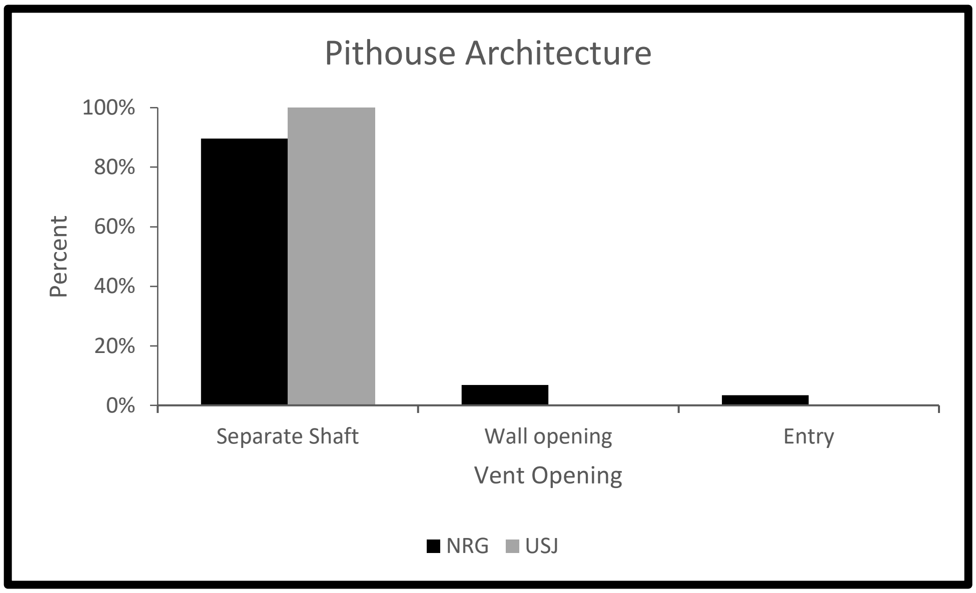


Figure A.14 Vent Opening Frequencies

Freq: Frequency

Contingency Table

Vent Opening

Subregion: Count / Expected	Above-floor	Not above-	Total
NRG	19	13	32
	17.4545	14.5455	
USJ	11	12	23
	12.5455	10.4545	
Total	30	25	55

Tests

N	DF	-LogLike	RSquare (U)
55	1	0.36000231	0.0095

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	0.720	0.3961
Pearson	0.720	0.3962

Fisher's Exact Test	Prob	Alternative Hypothesis
Left	0.8693	Prob(Vent Opening=Not above-floor) is greater for Subregion=NRG than USJ
Right	0.2829	Prob(Vent Opening=Not above-floor) is greater for Subregion=USJ than NRG
2-Tail	0.4245	Prob(Vent Opening=Not above-floor) is different across Subregion

Figure A.15 Vent Opening Chi Squared

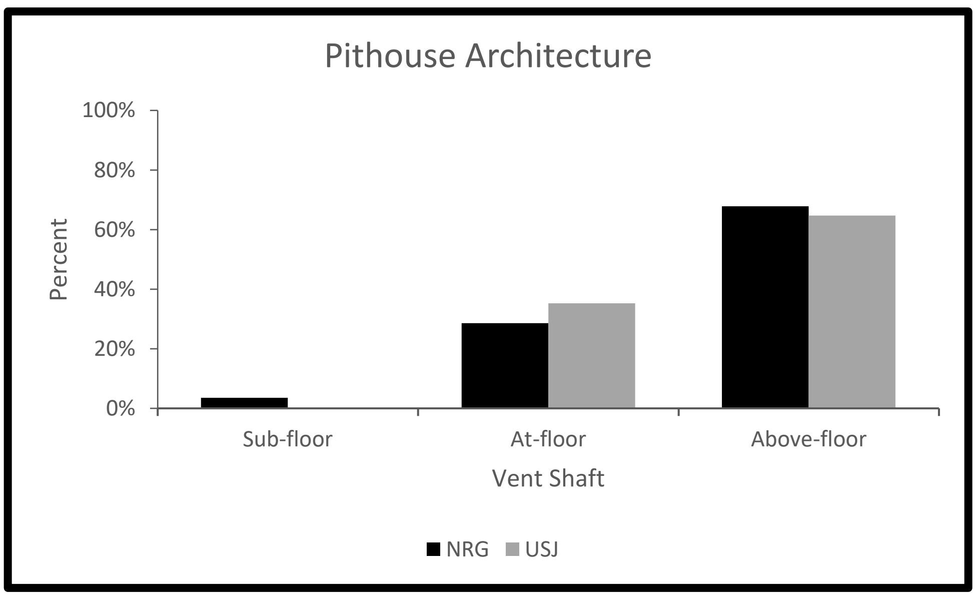


Figure A.16 Vent Shaft Frequencies

Freq: Frequency

Contingency Table

Vent Shaft

Subregion / Count / Expected	Not separat	Separat e	Total
NRG	6	26	32
	6.4	25.6	
USJ	5	18	23
	4.6	18.4	
Total	11	44	55

Tests

N	DF	-LogLike	RSquare (U)
55	1	0.03716545	0.0014

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	0.074	0.7851
Pearson	0.075	0.7846

Fisher's Exact Test	Prob	Alternative Hypothesis
Left	0.5224	Prob(Vent Shaft=Separate) is greater for Subregion=NRG than USJ
Right	0.7324	Prob(Vent Shaft=Separate) is greater for Subregion=USJ than NRG
2-Tail	1.0000	Prob(Vent Shaft=Separate) is different across Subregion

Figure A.17 Vent Shaft Chi Squared

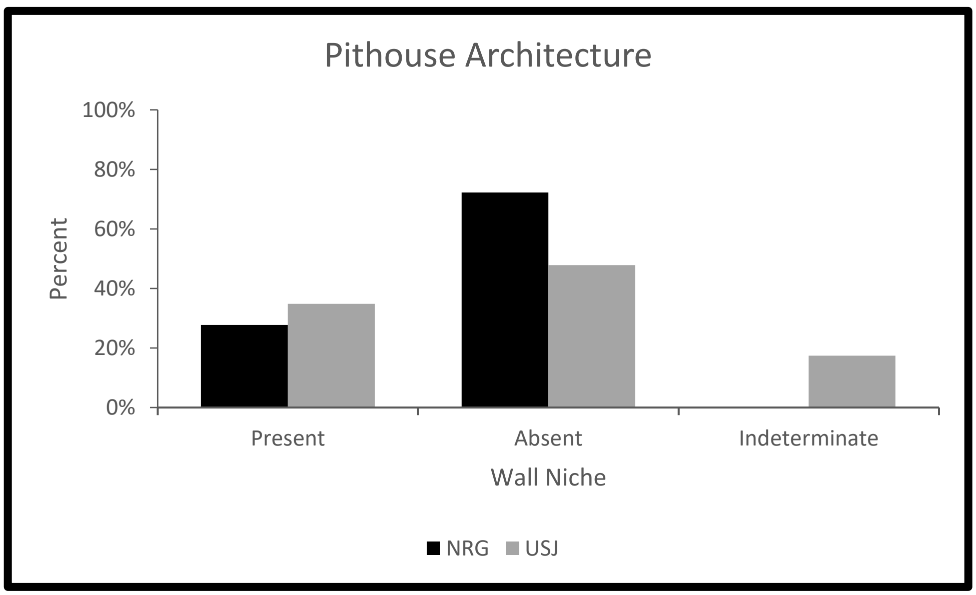


Figure A.18 Wall Niche Frequencies

Freq: Frequency

Contingency Table

Wall Niche

Subregion	Count / Expected	Absent	Present	Total
NRG		13	5	18
		10.5366	7.46341	
USJ		11	12	23
		13.4634	9.53659	
Total		24	17	41

Tests

N	DF	-LogLike	RSquare (U)
41	1	1.2627364	0.0454

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	2.525	0.1120
Pearson	2.476	0.1156

Fisher's Exact Test	Prob	Alternative Hypothesis
Left	0.9720	Prob(Wall Niche=Present) is greater for Subregion=NRG than USJ
Right	0.1044	Prob(Wall Niche=Present) is greater for Subregion=USJ than NRG
2-Tail	0.2011	Prob(Wall Niche=Present) is different across Subregion

Figure A.19 Wall Niche Chi Squared

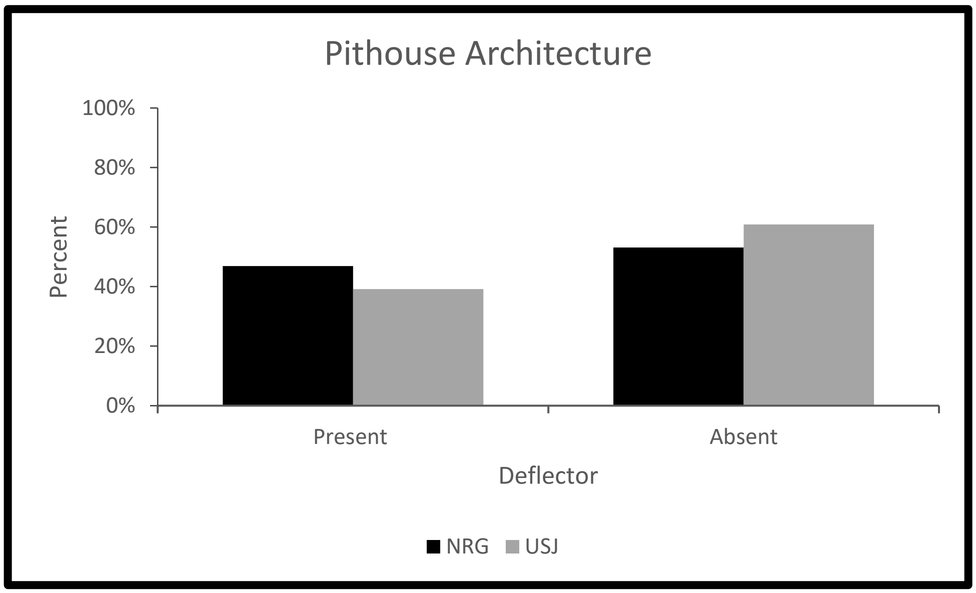


Figure A.20 Deflector Frequencies

Freq: Frequency

Contingency Table

Deflector

Subregion	Count / Expected	Absent	Present	Total
	NRG	17	15	32
		18.0364	13.9636	
	USJ	14	9	23
		12.9636	10.0364	
	Total	31	24	55

Tests

N	DF	-LogLike	RSquare (U)
55	1	0.16371774	0.0043

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	0.327	0.5672
Pearson	0.326	0.5678

Fisher's Exact Test	Prob	Alternative Hypothesis
Left	0.3846	Prob(Deflector=Present) is greater for Subregion=NRG than USJ
Right	0.8011	Prob(Deflector=Present) is greater for Subregion=USJ than NRG
2-Tail	0.5945	Prob(Deflector=Present) is different across Subregion

Figure A.21 Deflector Chi Squared

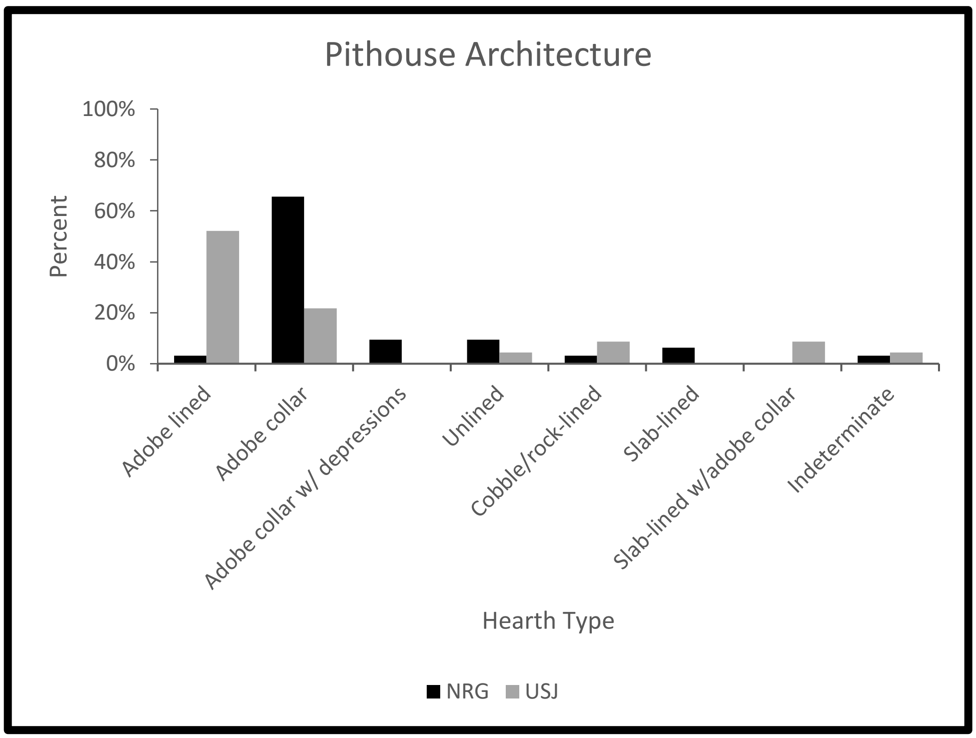


Figure A.22 Hearth Type Frequencies

Freq: Frequency

Contingency Table

Adobe Hearth Collar

Subregions — Count / Expected	Absent	Present	Total
NRG	11 10.4727	21 21.5273	32
USJ	7 7.52727	16 15.4727	23
Total	18	37	55

Tests

N	DF	-LogLike	RSquare (U)
55	1	0.04736471	0.0014

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	0.095	0.7582
Pearson	0.094	0.7587

Fisher's Exact Test	Prob	Alternative Hypothesis
Left	0.7236	Prob(Adobe Hearth Collar=Present) is greater for Subregions=NRG than USJ
Right	0.4959	Prob(Adobe Hearth Collar=Present) is greater for Subregions=USJ than NRG
2-Tail	1.0000	Prob(Adobe Hearth Collar=Present) is different across Subregions

Figure A.23 Adobe Hearth Collar Chi Squared