Coalescence and Population Movement in the Rio Chama Drainage

By

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Archaeologists have understood general trends in population movement throughout the Tewa Basin for over 50 years (Wendorf and Reed 1955). While a sizable indigenous population inhabited the southern portion of the Basin in the Early Coalition period (A.D. 1200-1250) the area experienced tremendous population growth in the thirteenth and fourteenth centuries. These large villages than began to coalesce into fewer but larger sites (and population centers) which eventually resulted in just a handful of villages located on the Rio Grande by Spanish colonization.

( SLIDE ) While informative, this general model does not provide the resolution needed to understand the specific timing of regional in-migration or the processes of coalescence. Ortman’s previous paper and dissertation (2010) demonstrates that archaeologists are beginning to think creatively in terms of modeling Pueblo movement in the Tewa Basin. In combination with other recent research in the northern Rio Grande (Fowles 2004a; Gabler 2009; papers in Kohler (ed.) 2004) archaeologists are beginning to create detailed population histories of growth and abandonment. However, the northern Rio Grande region, and specifically the Tewa Basin, provides specific challenges for those studying prehispanic population movement where room count estimates and chronological control are essential. These challenges include the fact that 1) the villages were occupied for multiple centuries, 2) the majority of sites are unexcavated, 3) the formerly grand adobe pueblo construction has weathered into low earthen mounds, and 4) because large-scale future excavation is unlikely archaeologists must rely primarily on surface archaeology.

In this paper I present several methods to better estimate room counts and site chronologies in the Rio Chama drainage in the northwest corners of the Tewa Basin, focusing on large Late Coalition (A.D. 1275-1325) and Classic Period (A.D. 1325-1600) adobe pueblos.
These data are essential in any sort of demographic reconstruction. I conclude by using these data in a preliminary population model to demonstrate the timing of population in-migration, the rate of population coalescence, and the date of probable cessation of large-scale building episodes in the early sixteenth century.

**The study area**

(SLIDE) The Tewa Basin is positioned along the Rio Grande, and extends west to east from the Jemez Mountains to the Sangre de Cristos and south to north from Santa Fe to north of Abiquiu Reservoir. In this paper I focus on the Rio Chama drainage located in the northwest corner of the Tewa Basin. This area is unique in that there was no significant habitation in the Chama until the Late Coalition period when the area experienced substantial immigration, likely from the Four Corners region of southwest Colorado and northwest New Mexico (Ford et al. 1972; Ortman 2010). Over an approximately 300 year period 32 large pueblos located in Chama underwent processes of population coalescence and demographic decline (Beal 1987). By Spanish colonization in 1598 only six Tewa villages remained occupied, all of which were located along the Rio Grande (Schroeder and Matson 1965).

(SLIDE) This project examines 13 Late Coalition and Classic period in the Chama. I use both site mapping and ceramic analysis to understand processes of pueblo growth and abandonment as well as regional population histories.

**Estimating rooms**

(SLIDE) The large (over 50 rooms in size) Late Coalition and Classic period pueblos in the Chama were primarily built using adobe. More than a half of millennia of weathering and
erosion have reduced the architecture to earthen mounds. Due to the relative dearth of
evacuation in the Chama many of the site’s published room counts are based on subjective
estimates. Archaeologists have estimated room counts based on extrapolating excavated room
sizes to unexcavated portion of a site based on mound length and width (Fallon and Wening
1987; Wendorf 1953). Estimating rooms based on multiple stories has been even more
subjective. Measuring the height of the housemounds may give a rough understanding of how
many stories were present, but local factors including vegetation, slope, and soil composition
may lead to different erosional processes. To skirt this problem I propose using the measurement
of housemound volume to begin to understand room count and especially address the problems
of stories.

(SLIDE) During site mapping I used a total station to record a grid of X, Y, and Z points
across eleven sites in the Chama. I also mapped the boundary of the mounds in relation to the
surrounding landscape and recorded features such as kivas, middens, rock alignments, looters’
pits, and un-backfilled professional excavations. With this three-dimensional data I was able to
extrapolate the volume of the architectural mounds free of the surrounding landscape using raster
algebra in ArcGIS.

(SLIDE) To use the volumetric data to understand the number of rooms in each house
mound I built a simple pueblo decomposition model to predict the number of rooms and stories
within each mound. Once a hypothetical volume for a one-story roomblock is known it is
possible to use the known volume to understand how many stories/rooms were present. Based
on limited excavation records of Late Coalition and Classic period sites I assumed that an
Ancestral Tewa pueblo roomblock consists of 2-6 tiers of rooms, and each room has the average
dimensions of 4.27m x 2.2m (Fallon and Wening 1987). Wall thickness averages 30cm (Fallon
and Wening 1987; Greenlee 1933; Wendorf 1953). Using archaeological examples from around the Southwest I determined that wall height for a single room may have averaged 2.5m and the mean ceiling thickness was 30cm (Riggs 2001). When a pueblo is not maintained I assume that these various elements will collapse and melt to form a similar volume of melted adobe in the house mound. Because rooms share walls it is necessary to estimate how many room tiers are present in each room block and also how many rooms were present per tier. Using this information the following formula, built into an Excel spreadsheet, provides a hypothetical volume for a one-story room block:

$$V_l = (T+1)[W_h W_w (R_l R_t + W_w (R_t + 1))]$$

$$V_w = (R_w T W_h W_w)(R_t + 1)$$

$$V_c = [R_l R_t + W_w (R_t + 1)][(R_w T) + W_w (T + 1)] C_d$$

$$V_h = V_l + V_w + V_r$$

Where:

- $R_l$ is the length of the room (using an averaged value from excavations)
- $R_w$ is the width of the rooms (using an averaged value from excavations)
- $W_w$ is the width of the wall (using an averaged value from excavations)
- $R_t$ is the number of estimated rooms per tier
- $T$ is the number of estimated room tiers
- $W_h$ is the estimated height of the wall
- $C_d$ is the estimated depth of roof/ceiling fill
- $V_l$ is the hypothetical volume measurement for the walls dividing room tiers
- $V_w$ is the hypothetical volume measurement for the wall dividing rooms within a tier
- $V_c$ is the hypothetical volume measurement for the roof/ceiling
- $V_h$ is the total hypothetical volume measurement

(SLIDE) To build and test this model I chose the site of Kap (LA 300) which I mapped in 2008 and was partially excavated in the 1950s (Luebben 1953). The site ranges from two to five tiers wide and the room average falls within the expected range for prehispanic Tewa sites. Importantly, the site is thought to only be one story tall. To begin I first needed to understand how to use two-dimensional mound measurements to estimate the number of room tiers and also
the amount of rooms per tier. Based on averages built from measuring mound length and width to known number of rooms per tier and room tiers from excavated sites (Kap [Luebben 1953]; Ponsipa [Bugé 1978], and Tsama [Greenlee 1933]) I estimate that 4.5 meters of mound length equals one room in a room tier and 5 meters of mound width equals one room tier.

Once I measured the length and widths of the mounds at Kap my model provided an estimate for the number of ground-floor rooms and a hypothetical volume for a one story pueblo. I then divided the true volume (measured by three-dimensional mapping) by the hypothetical volume produced by the model. The resulting index (.95), very close to a 1:1 relationship between the true and hypothetical volumes, indicates that the model predicts a one-story pueblo that Luebben (1953) observed through excavation.

To demonstrate how this model can be used to understand a complex and multi-storied pueblo I use Ponsipa (LA 297) as a case study. The site’s eight housemounds are well-defined and exhibit appreciable variation in height. After calculating the number of room tiers and rooms per tier at each roomblock I divided my hypothetical volumes by the true volumes. These indices ranged from 0.87 to 2.54. Clearly multiple roomblocks were multistoried. The resulting index was then multiplied with the estimated number of ground floor rooms to provide an estimate of the total number of rooms per roomblock. An index of over 1.5 could indicate two or even three additional stories based on how the pueblo was constructed. My calculations estimated the number of total rooms at Ponsipa to be 972 which is significantly smaller than the published value of 1350 rooms (Fowles 2004b).
**Chronological concerns**

(Slide) Most of our basic chronological knowledge of sites in the Rio Chama drainage comes from limited excavation, the presence/absence of surface ceramic types, and mostly unprovenienced dendrochronological samples taken by the Museum of New Mexico in the 1930s. The basic chronological trends of population growth in the eleventh and twelfth century, and subsequent coalescence preceding Spanish colonization, have been well known since the 1950s (Wendorf and Reed 1955). The obvious problem with using presence/absence ceramic data in the northern Rio Grande is the apparently long use life of types of Tewa Series black-on-white pottery. Most of the large sites have a smattering of all types and have therefore been dated from 1325/1350 to 1600. This is obviously problematic when considering the various documented life histories of pueblo growth and abandonment (Crown 1991; Riggs 2001), specifically in the case of Arroyo Negro where the pueblo was built by accretion and was not occupied fully at any time (Creamer et al. 2002).

My work has sought to use ceramic analysis from surface contexts (with additional reanalysis of excavated ceramic from Howiri [LA 71]) to attempt to better understand patterns of village growth. I analyzed pottery from seven sites in the Rio Chama and typed 20,000 sherds and recorded attributes (temper, paste, paint, etc.). These sherds, although from surface contexts, were collected from 8-12 discreet units across a site.

(Slide) To understand basic chronological questions I applied ceramic mean dating (with knowledge of the pitfalls of this method) based on accepted chronological periods of manufacture to the five major Tewa Series black-on-white types found in the Chama: Santa Fe B/w, Wiyo B/w, Abiquiu B/w (Biscuit A), Bandelier B/w (Biscuit B), and Sankawi B/c (Breternitz 1966; Habicht-Mauche 1993; Harlow 1973). Surprisingly, the mean dating estimates
place the end of many of the site’s occupational histories at A.D. 1500 which is slightly earlier than traditional published dates. However, based on the unprovenienced (but site specific) tree-ring dates in the Rio Chama there is only one sample that dates to the sixteenth century and this is a 1502 cutting date from Hupobi (LA 380) (Smiley, Stubbs, and Bannister 1953). I do not believe that there was significant room building episodes in the Chama past A.D. 1500.

(SLIDE) At some sites with long periods of accretional growth I believe I have also been able to seriate the ceramics based on spatial patterning. For example, Ponsipa (LA 297) has three major occupational phases: Roomblocks 7 and 8 date to the Late Coalition period, Roomblocks 4, 5, and 6 date to the Early and Middle Classic periods, and Roomblocks 1, 2, and 3 date to the Middle and Late Classic. I performed ceramic mean dating from pottery adjacent to each roomblock to understand the timing of accretional growth at the site.

(SLIDE) At other long occupied sites such as Pose (LA 632) and Hupobi (LA 380) I was unable to seriate surface ceramics (probably due to natural and human disturbance). Ku (LA 253) provided the same problem, but I believe this is due to the site’s relatively non-accretional building history and relatively short occupational duration.

While surface ceramics pose many problems such as representing the final activity of the site, and are subject to both systemic and modern mixing, these sherds often offer the best data available to begin to date prehispanic Tewa Basin pueblos at both an inter- and intra-site level.

A preliminary population model

To demonstrate how these new data can be used to model population movement in the Rio Chama drainage I have used these data in conjunction with Ortman’s pueblo growth function.
My research has only covered a sample of the large sites in the Chama and therefore I relied on room estimate and chronological data from published and archival sources to fill in the gaps. I make the common assumption that one room is roughly equal to one person in terms of population. I also retained Ortman’s periods of momentary population for sake of consistency and also because they correspond well to the dates of local pottery types.

At sites where I could seriate the ceramics by roomblocks (e.g. Ponsipa) I used my room estimate data to assign room counts to each appropriate period. I utilized Ortman’s growth function, explained in the previous paper and elaborated on in his dissertation (Ortman 2010), to calculate population growth in pueblos where I could not seriate surface ceramics and hence gain intra-site chronological control. I also used this function to evaluate Chama sites that were not analyzed in this project. Due to time constraints I was unable to analyze sites under 50 rooms in size, so I used Ortman’s population numbers for the Chama drainage.

(SLIDE) The following is a dissemination of this data by period. [Talk off of slides] The Chama underwent its first great surge of population in-migration between A.D. 1275-1350. Between A.D. 1350-1400 the population nearly doubled as another wave of immigrants traveled to the Chama, likely from the northern and central Pajarito Plateau (Ortman 2010). As an aside, additional ceramic compositional research I have conducted supports this hypothesis. Between A.D. 1400-1500 the region’s population begins to coalesce with very large (over 1,000 room) towns being commonplace by peak population in A.D. 1480. By A.D. 1500 most large-scale building ceases in the Chama and by 1540 the majority of the population appears to have coalesced to Tewa villages on or near the Rio Grande. Surprisingly, this model demonstrates that full-time habitation of the Rio Chama drainage appears to have ceased in the early 1500s prior to Spanish colonization. If this conclusion stands, we who are interested in the
Protohistoric Period must begin to rethink the causes and effect of coalescence in terms of both ecological and social contexts.

My analysis (and to a much larger scale, Ortman’s) provides momentary room counts for the Rio Chama drainage. Creating population estimates based on this metric is an inherent problem in the Southwest, and likely even more of a concern in the northern Rio Grande. Anschuetz (2007) alerts us to the possibility of the Tewa overbuilding architecture based on his analysis of caloric needs and the limits of arable land in the region. In short, because we are most likely overestimating regional population, ecological and subsistence modeling (e.g. this session) can act as an important ceiling for demographic models.

Conclusions

(SLIDE) The benefits of using surface archaeology to estimate data such as room counts and site chronologies appear to outweigh the negatives. Although room counts and site chronologies generated by these methods and model are built on a series of assumptions, I have tried to make these assumptions as explicit as possible. Good models are based on solid data, and I look forward to working with the researchers in this room on further refining these methods and eventually creating a high-resolution population model for the northern Rio Grande.
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Wendorf, Fred

Wendorf, Fred and Erik K. Reed
The problems of northern Rio Grande archaeology

- Villages were occupied for multiple centuries
- The majority of sites are unexcavated
- Adobe architecture has melted to poorly defined mounds
- We must rely on surface archaeology
The Rio Chama Drainage
# Scope of Research

<table>
<thead>
<tr>
<th>Site (LA Number)</th>
<th>Area</th>
<th>Dates?</th>
<th>Site Mapped</th>
<th>Ritual Landscape Mapped</th>
<th>Ceramic Analysis</th>
<th>Compositional Analysis</th>
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<td>Howiri (LA71)</td>
<td>Rio Ojo Caliente</td>
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<td>Hupobi (LA380)</td>
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<td>Pose (LA632)</td>
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Pueblo sites today
Mapping and Measuring Volume

Original micro-topographic surface model

Surface model with housemounds removed
Hypothetical Pueblo Volume Model

\[ V_I = (T+1)[W_h W_w (R_l R_t + W_w (R_t+1))] \]
\[ V_w = (R_w T W_h W_w)(R_t+1) \]
\[ V_c = [R_l R_t + W_w (R_t+1)][(R_w T) + W_w (T +1)]C_d \]

\[ V_h = V_I + V_w + V_r \]

Where:
- \( R_l \) is the length of the room (using an averaged value from excavations)
- \( R_w \) is the width of the rooms (using an averaged value from excavations)
- \( W_w \) is the width of the wall (using an averaged value from excavations)
- \( R_t \) is the number of estimated rooms per tier
- \( T \) is the number of estimated room tiers
- \( W_h \) is the estimated height of the wall
- \( C_d \) is the estimated depth of roof/ceiling fill
- \( V_I \) is the hypothetical volume measurement for the walls dividing room tiers
- \( V_w \) is the hypothetical volume measurement for the wall dividing rooms within a tier
- \( V_c \) is the hypothetical volume measurement for the roof/ceiling
- \( V_h \) is the total hypothetical volume measurement

Drawing from Riggs 2001, Figure 3.3
Testing the Model: Kap (LA 300)

Estimating the numbers of room tiers and rooms per tier:

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<thead>
<tr>
<th></th>
<th>One room tier</th>
<th>5 meters of mound width</th>
</tr>
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<tbody>
<tr>
<td>One room in tier</td>
<td>4.5 meters of mound length</td>
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Calculating number of hypothetical rooms:

<table>
<thead>
<tr>
<th></th>
<th>Room tiers</th>
<th>Room per tier</th>
<th>Ground floors</th>
<th>Volume (l walls)</th>
<th>Volume (w walls)</th>
<th>Roof volume</th>
<th>Total volume</th>
<th>Index</th>
<th>Total rooms</th>
<th>Possible stories</th>
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<tr>
<td></td>
<td>14</td>
<td>45</td>
<td>137</td>
<td>641.5</td>
<td>249.2</td>
<td>502</td>
<td>1392.7</td>
<td>0.95</td>
<td>137</td>
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Using the Model: Ponsipa (LA 297)

Based on mound height and plan measurements the site has been estimated to have 1350 rooms.
### Using the Model: Ponsipa (LA 297)

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<thead>
<tr>
<th></th>
<th>RB 1</th>
<th>RB 2</th>
<th>RB 3</th>
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<td>4</td>
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<td>Room per tier</td>
<td>19</td>
<td>47</td>
<td>26</td>
<td>38</td>
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<tr>
<td>Ground floors</td>
<td>76</td>
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<td>130</td>
<td>194</td>
<td>126</td>
<td>54</td>
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<tr>
<td>Volume (I walls)</td>
<td>333.9</td>
<td>824.2</td>
<td>547.7</td>
<td>815.3</td>
<td>538.6</td>
<td>222.2</td>
<td>166.4</td>
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<td>Volume (w walls)</td>
<td>132</td>
<td>316.8</td>
<td>222.8</td>
<td>336.6</td>
<td>224.4</td>
<td>99</td>
<td>69.3</td>
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<td>Roof volume</td>
<td>275.1</td>
<td>679.2</td>
<td>467.4</td>
<td>697.8</td>
<td>455</td>
<td>194.3</td>
<td>132.1</td>
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<td>Full volume</td>
<td>741</td>
<td>1820.2</td>
<td>1237.9</td>
<td>1849.6</td>
<td>1217.9</td>
<td>515.5</td>
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<td>True volume</td>
<td>898.8</td>
<td>2141</td>
<td>2346.5</td>
<td>4701.8</td>
<td>2515.8</td>
<td>566.5</td>
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<td>Index</td>
<td>1.2</td>
<td>1.2</td>
<td>1.9</td>
<td>2.5</td>
<td>2.1</td>
<td>1.1</td>
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<td>221.1</td>
<td>246.4</td>
<td>172.9</td>
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<td>Total rooms</td>
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</table>
Chronological Concerns

-Presence/absence use of ceramic types create the illusion that large sites were all used for multiple centuries.

-I examined pottery, mostly from surface contexts, to gain chronological control (both inter- and intra-site)
-20,000 sherds from 7 sites in the Chama

<table>
<thead>
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<th>Type</th>
<th>Date</th>
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<tr>
<td>Santa Fe B/w</td>
<td>1175-1350</td>
</tr>
<tr>
<td>Wiyo B/w</td>
<td>1275-1400</td>
</tr>
<tr>
<td>Biscuit A</td>
<td>1350-1450</td>
</tr>
<tr>
<td>Biscuit B</td>
<td>1400-1540</td>
</tr>
<tr>
<td>Sankawi</td>
<td>1500-1600</td>
</tr>
</tbody>
</table>
Ceramic Analysis (inter-site)

<table>
<thead>
<tr>
<th>Site</th>
<th>Start</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsiping (LA 301)</td>
<td>1298</td>
<td>1400</td>
</tr>
<tr>
<td>Sandoval (LA 98319)</td>
<td>1301</td>
<td>1400</td>
</tr>
<tr>
<td>Ponsipa (LA 297)</td>
<td>1324</td>
<td>1500</td>
</tr>
<tr>
<td>Hupobi (LA 380)</td>
<td>1350</td>
<td>1500</td>
</tr>
<tr>
<td>Hilltop (LA 66288)</td>
<td>1369</td>
<td>1500</td>
</tr>
<tr>
<td>Pose (LA 632)</td>
<td>1372</td>
<td>1474</td>
</tr>
<tr>
<td>Ku (LA 253)</td>
<td>1373</td>
<td>1484</td>
</tr>
<tr>
<td>Howiri (LA 71)</td>
<td>1392</td>
<td>1523</td>
</tr>
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</table>
Ponsipa Intra-Site Chronology

<table>
<thead>
<tr>
<th></th>
<th>Start</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
<td>1289</td>
<td>1410</td>
</tr>
<tr>
<td>Middle</td>
<td>1326</td>
<td>1467</td>
</tr>
<tr>
<td>Late</td>
<td>1350</td>
<td>1500</td>
</tr>
</tbody>
</table>
Ku (LA 253) Ceramic Analysis (intra-site)

<table>
<thead>
<tr>
<th>Culture</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Fe B/w</td>
<td>1175-1375</td>
</tr>
<tr>
<td>Wiyo B/w</td>
<td>1250-1375</td>
</tr>
<tr>
<td>Biscuit A</td>
<td>1375-1450</td>
</tr>
<tr>
<td>Biscuit B</td>
<td>1400-1550</td>
</tr>
<tr>
<td>Sankawi</td>
<td>1550-1650</td>
</tr>
<tr>
<td>Sepawe Washboard</td>
<td>1425-1600</td>
</tr>
<tr>
<td>Potsuwi’I Incised</td>
<td>1550-1650</td>
</tr>
</tbody>
</table>
A Preliminary Population Model

- Used to room estimate and chronological data in Ortman’s (2010) pueblo growth model
- Published/archival data was used to “fill in the gaps”
- One room = one person (tentatively)
- Where I had intra-site chronological control (i.e. Ponsipa) I used this data over the growth function

<table>
<thead>
<tr>
<th>900-1050</th>
<th>1050-1200</th>
<th>1200-1275</th>
<th>1275-1350</th>
<th>1350-1400</th>
<th>1400-1450</th>
<th>1450-1500</th>
<th>1500-1540</th>
<th>1540-1600</th>
<th>1600-1680</th>
<th>1680-1700</th>
<th>1700-1760</th>
</tr>
</thead>
<tbody>
<tr>
<td>553</td>
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<td>505</td>
<td>2843</td>
<td>6926</td>
<td>11988</td>
<td>11444</td>
<td>5739</td>
<td>540</td>
<td>513</td>
<td>36</td>
<td>36</td>
</tr>
</tbody>
</table>
A.D. 1050-1200
There was no sizeable Developmental or Early Coalition Period Pueblo population in the Rio Chama drainage.
A.D. 1200-1275
The first migrants into the Chama likely arrived from the Four Corners region, perhaps traveling through the Pajarito Plateau or lower Tewa Basin.
A.D. 1275-1350
Migration continued into the Chama, and by A.D. 1350 the region was widely populated by people living in dispersed small hamlets and villages.
Population Movement in the Rio Chama Drainage
(sites over 50 rooms are displayed on map)

A.D. 1350-1400
The region experiences a large push of migration; people are likely coming from the northern Pajarito Plateau to farm the river valleys of the Chama drainage.
A.D. 1400-1450
Coalescence begins with people moving to larger and fewer villages. These villages begin to increase in size.
Population Movement in the Rio Chama Drainage
(sites over 50 rooms are displayed on map)

A.D. 1450-1500
Coalescence continues and towns of over 500 rooms are commonplace. Population peaks during this period.
Population Movement in the Rio Chama Drainage
(sites over 50 rooms are displayed on map)

A.D. 1500-1540
Population quickly declines with Tewa people likely coalescing at historic and modern villages along the Rio Grande. Few very large villages remain.
A.D. 1540-1600

During the Protohistoric Period there was little new building in the Chama, but Spanish explorers named occupied sites that were likely being used sparsely.
A.D. 1600-1680
During the Historic Period Spanish occupation of New Mexico constrained Tewa movement and use of their ancestral homeland, although some sites appear to have been reoccupied.
A.D. 1680-1700
We know little about life in the Chama during and after the Pueblo Revolt, although it is likely that the Tewa took refuge in their familiar landscape.
A.D. 1700-1760
While there was little full-time occupation of the Chama in the eighteenth century, the Tewa did use the landscape for both subsistence and sacred needs. They continue to do so today.
Population Movement in the Rio Chama Drainage
(sites over 50 rooms are displayed on map)
Conclusions

• Surface archaeology is problematic, but it offers a better set of data than we have currently (without excavation)
• This analysis makes many assumptions, but I have tried to make them explicit (so they can be changed and tweaked)
• The good environmental models created in this session can act as a check and balance to the trend of overestimating population in the northern Rio Grande region.