**Date Queries**

The first piece was to take the **DatasetRecuay\_Cleaned** and generate layers to show the different eras. Each of the layers contains the same dataset, just queried to show an era better. Some sites in the dataset were single use burial plots, while others were residential areas occupied for the entire first millennium AD. Some sites are represented multiple times in the various layers below, implying they were in use in multiple eras. All of the sites are represented at least once in the subset layers below. These divisions represent the fundamental units of analysis for the first round.

**Existent Sites in AD 1** The first layer was queried so that the Date Start is less than or equal to 0, implying the site has a start date from the before the first century. This layer is primarily used as a means of showing the dataset before the Recuay era, a convenient starting place when the formative cultures were themselves in formative phases. This subset contained twenty-one records.

**Huaras Recuay** This layer was queried so the Date Start equals -200 (200 BC). Only the sites with a Huarás occupation were coded with a start date at -200. There are some sites which eventually had evidence of a Recuay presence after the Huarás presence, these are all in this subset. This subset contained a total of ten records.

**Classic Recuay** This layer was queried so the Date Start was greater than or equal to zero and the Date Start was less than 600. Together these select sites between AD 1 and 600: sites occupied during the Classic Recuay era. After AD 600 the Recuay begin the process of becoming indistinguishable from the Wari incursion. This subset contained a total of thirty-three records.

**Late Recuay** This layer was queried so the Date End was greater than or equal to 650. The Late Recuay Era starts in AD 650. There is a bit of a gap between Classic’s end in 600 and Late’s beginning in 650. That distinction was built into the data deliberately as a distinction to divide Classic and Late era sites. This subset contained a total of forty-six records.

**Post Recuay** This layer was queried so the Date End is greater than 700. This would produce only sites whose ending was after the Recuay and in the Wari era. Some sites were used or occupied through Inka and even to Spaniard times, the exact end date for each site is grouped together if it is after AD 700. There were twelve records in this subset.

This dataset contains all the sites present for this project. Naturally most of the sites fall into the Classic and Late Recuay. Any site present in the dataset should have at least a portion of its date range within the Recuay era. The Huarás and Post Recuay were not the focus of this project, so they are only represented when the sites have a Recuay occupation as well.

**Maybe test for oversampling?**

**Description of the test Sequence [should this be in ch4 methods?]**

There are a total of six trials in the first round, each of them running a set of analysis on the numerical variables. There are two tests used for this first round of analysis. Moran’s I and Getis G are the primary means of assessing spatial autocorrelation and hotspot analysis. Though both tests discuss clustering, the results are distinct from one another.

When the global statistics are not significant, local statistics can be used. “When a global test does not indicate a significant degree of clustering, local statistics can be useful in deciding whether a) the study area is relatively homogeneous in the sense that local statistics are quite similar throughout the area or b) there are local outliers that contribute to a significant global statistic”. (Peterson 2015: 308). Both Global and Local tests can complement one another by showing the data is clustered and values of high or low are found near one another.

Moran’s I is the classic statistic for assessing spatial autocorrelation. It was pioneered in the late 1940s for use in assessing points for spatial ‘joins’ in the data. The test assumes either that the points are independent from one another, or that they were randomly arranged (Moran 1948). For the purposes of this project, all points are assumed independent from one another. Though they are not randomly arranged, there was no indication that any site was assigned values identical to another. There is independence, if not randomness implied.

Moran’s I Global statistic generates a co-efficient between zero and one. The I value of positive one indicates a strong spatial clustering in that area. The points tend to contain high values and low values adjacent or nearby one another. An I value of negative one indicates a strong negative autocorrelation. This implies the points are truly dispersed with high and low values around one another. An I value of zero indicates an absence of a pattern. This indicates there is something akin to randomness as the prominent feature (Rogerson 2015: 302).

Patterns in the data are autocorrelated when observed values geographically near one another possess similar values. The I statistic can demonstrate that values near one another are not random, but that an extraneous factor of geography is influencing the data. This is good for social sciences because many features created by man are placed deliberately. Showing that a given variable is more clustered than could be random is another way of saying that these features were consciously placed on the landscape.

The Global statistic is merely a descriptive statistic, a co-efficient implying relatedness or lack thereof in the overall dataset. The GIS program runs the weighted test, and then outputs the I co-efficient together with a Z-Scored value and a P-Test for significance. The P-Value of .05 was used as a general conventional cutoff. The output also displays a null curve demonstrating the probability the spatial patterns could be random based off the tests for significance. Though the global test can never display where the autocorrelation and dispersal occurs, it can demonstrate the presence of such correlation within the data.

Global statistics are calculated only for the Recuay Dataset, the Classic Recuay, and the Late Recuay. This was a deliberate decision as Moran’s I requires N=30 to produce results. The Huaras and Post Recuay layers had ten and twelve records respectively. Had I calculated Moran’s statistic the value would have outlandish degrees of freedom pushing the test statistic’s value towards insignificance.

Local tests are used to demonstrate the Global clusters spatially. Local Moran’s I runs a related analysis, though the output demonstrates the location of the autocorrelated or dispersed points. Local statistics can detect clusters which may or may not be significant across the entire dataset, but hold local significance (Rogerson 2015: 308-9).

The GIS output for Local (Anselin) Moran’s I is a map layer displaying the points with symbology to match. Where clusters occur they are placed into categories of high-high and low-low clusters. Outlier points occur whenever there is a point with values significantly different from the other points around it. These outliers are labeled based on whether they are high values surrounded by low values or low values surrounded by high. In either case there is an outlier occurring. It also can display in the output nonsignificant values. This case would imply any point is either random or near random with respect to points around them. These points are not autocorrelated with the points around them.

Getis’ Gi statistic is a test to locate clusters of high and low values. This test is a weighted and modified form of nearest neighbor test, but where that test only looks at distance between points the Gi statistic can identify higher and lower than average groupings in the data. The Gi test allows an assessment of whether the high and low values are clustered in a statistically meaningful way within the data. When the data is distributed normally the Gi can still find clusters of higher or lower than average values (Rogerson 2015: 309-310).

Third test is Getis Gi General, the global statistic which calculates hot and cold clusters in the data. The global test does not produce a layer, but a Gi value, a Z-score for that Gi, and then runs the standard P-test on the Z-score. This value is then interpreted at the .05 significance level as evidence for significant global clustering of high and low values. As with the Global Moran’s I calculation, this is an descriptive statistic across the entire dataset. Positive Global Gi values imply clustering of values above the mean while negative Gi values imply clustering of values below the mean. Also the points of data have to be above N=30 for the Global calculation to be meaningful, so Global Gi was only calculated on the Recuay dataset, Classic Recuay, and Late Recuay layers.

The Fourth test is the Getis Ord Gi which calculates local stats and produces a layer showing the clustering of high and low values. The output is a set of points at the 90%, 95%, and 99% confidence level, each coded by red for high and blue for low. There are also outliers identified by each local trial. There are high-low outliers, points in the data where an outlier has a value significantly higher than the neighborhood’s values, and low-high outliers where a point has value significantly lower. Either can be significant or interesting to assess because outliers often show something interesting or unusual in the data points within that neighborhood.

For each of the six trials Global I and Gi values were produced for the Recuay dataset, Classical, and Late Recuay eras. Then Local I and Gi were produced for the Recuay dataset, Existent Sites in AD1, Huaras-Recuay, Classical Recuay, Late Recuay, and Post-Recuay layers.

**Trial 1**

The first trial showed without question that the datasets used in this project were sensitive to the Moran’s I and Getis Gi calculations at the local and global level. More than anything this demonstrates that the datasets and method of analysis can work together. All four tests produced significant values, but also all four tests were designed to show a demonstrative clustering. As I entered the values they were given an ID number sequentially starting with the first point AC02 in the Bria dataset and ending with Ushnu de Cajay in the Ibarra dataset. All values were entered sequentially with respect to source. Although each source had its own series of sites, all were combined in a single sequence. The Bria dataset starts with ID 1 and goes to ID 17; Barbosa begins on ID 18 and ends on ID 20; Ponte begins on ID 21 and ends on ID 29; and finally Ibarra begins on ID30 and ends on ID 49.

From this setup the other values are all coded commonly and in the same way across datasets; it was just that ID number which changed. This allowed for a very basic test on the dataset to make certain it was sensitive to the tests by showing a clustering which I wrote into the dataset. The ID numbers for Bria are all at the extreme low end and the values for Ibarra are all on the high end. The value of the ID number does not mean anything beyond a classificatory column.

**Table 5.1: Trial 1 ID Number Global Statistics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test** | **Test Statistic** | **Z-Score** | **P-Value** | **Interpretation** |
| Recuay Dataset | I=0.957871 | Z=9.643685 | P=0.00 | Significantly positively autocorrelated |
| Recuay Dataset | Gi=0.027608 | Z=7.352501 | P=0.00 | Significant hotspot clustering |
| Classic Recuay | I=0.957871 | Z=7.668169 | P=0.00 | Significantly positively autocorrelated |
| Classic Recuay | Gi=0.041988 | Z=7.352501 | P=0.00 | Significant hotspot clustering |
| Late Recuay | I=0.949636 | Z=9.541934 | P=0.00 | Significantly positively autocorrelated |
| Late Recuay | Gi=0.029629 | Z=6.786307 | P=0.00 | Significant hotspot clustering |

The Global Moran’s I statistics showed that the dataset was extraordinarily clustered, far beyond what could possibly be randomly expected. The P-value of 0.00 is as certain as the test can possibly be that this represents deliberate clustering and not random chance. When the local tests were run, they showed Low-Low clustering in the Bria dataset and High-High clustering in the Ibarra dataset for both the Classic and Late Recuay eras. Getis Gi statistics complemented this trend with P-values of 0.00 again indicating these hot and cold spots cannot possibly be due to chance. Local Getis Gi statistics again pointed to hotspots in the Ibarra dataset, and coldspots in the Bria dataset. There were a few outliers between, but these are the significant results.

Local Moran’s I statistics for the Classic era produced Low-Low clustering around the points associated with Bria in the north, and a High-High clustering in the points near Huari from the Ibarra dataset. Barbosa and the sites from Ponte near Huarás are were insignificant. Local Getis G showed hotspots in Huari and coldspots near Santa Cruz. One point in the Barbosa dataset was a lesser cold point. These clusters and hotspots in the Classic era were as expected.

The Local Moran’s I statistics for the Late Recuay show the same pattern as during the Classic: High-High clustering in Huari and Low-Low in the Bria points around Santa Cruz. The Late Recuay dataset has more points than the Classical, but the clusters remained the same. The Local Getis Gi produced hotspots in Huari and coldspots in Santa Cruz. One point in the Barbosa set is a coldspot, while nothing around Huarás is significant.

These results demonstrate unequivocally that Trial 1 was successful. The purpose of Trial 1 was simply to test the dataset by applying the analytical method to a meaningless but highly clustered variable and see whether the test was able to identify those clusters. Trial 1 shows the clusters I wrote into the dataset. Trial 1 was not showing clusters in variables, but clusters in the dataset. From here on the presumption is that the dataset was sensitive to the tests applied and thus any results are in some way meaningful.

**Trial 2**

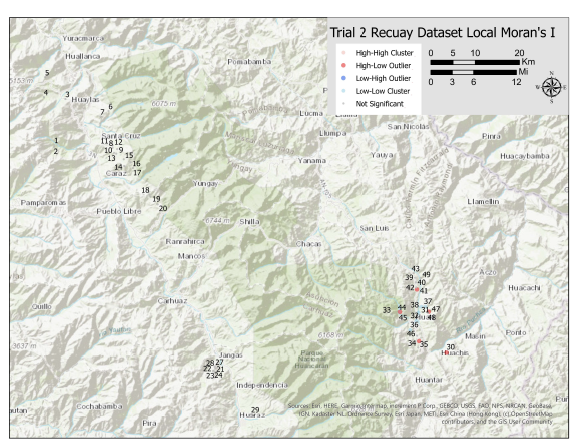
Trial 2 The second trial was run on the Burial\_Num variable. This variable was simply the presence or absence of human material for sites in the dataset. This trial was not sensitive to variances in number of individuals, only the presence of burial material. This allows us to infer mortuary versus nonmortuary sites. The original goal was to identify mortuary districts as distinct from residential, but the dataset does not seem sensitive enough to make such claims.

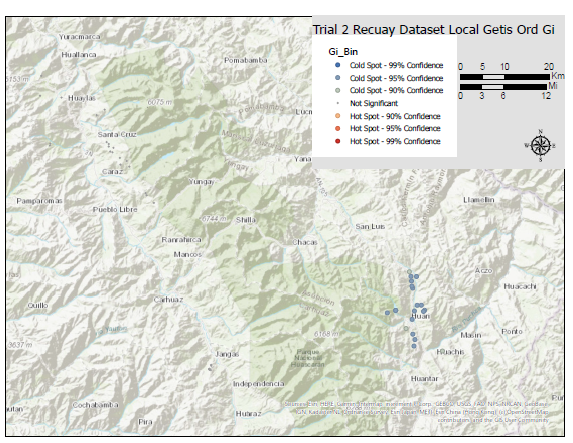
**Table 5.2: Trial 2 Binary Burial Global Statistics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test** | **Test Statistic** | **Z-Score** | **P-Value** | **Interpretation** |
| Recuay Dataset | I=0.006463 | Z=0.266675 | P=0.789720 | Insignificant autocorrelation Random clustered |
| Recuay Dataset | Gi=0.020457 | Z= -0.172047 | P=0.863410 | Insignificant coldspot clustering |
| Classic Recuay | I= -0.62948 | Z= -0.247280 | P=0.804692 | Insignificant autocorrelation Negative Clustering |
| Classic Recuay | Gi=0.029525 | Z= -0.578446 | P=0.562963 | Insignificant coldspot clustering |
| Late Recuay | I=0.014488 | Z=0.075282 | P=0.939991 | Insignificant autocorrelation Random clustering |
| Late Recuay | Gi=0.020244 | Z= -0.733104 | P=0.463495 | Insignificant coldspot clustering |

Global statistics for the Recuay dataset produced nothing significant, and local clustering only showed outliers. Existent sites similarly only showed outliers at the local levels. Both did show sites 44-45, the Laguna Purhuay locality, as outliers. The Classic Recuay dataset also showed nothing significantly different from random. There were outliers again in the local statistics, but they were relatively scattered throughout the dataset.

Local statistics for the Recuay Dataset showed low-low clustering around the Huari locality with a few outliers at sites 41,47,34,30, and at 44 and 45. Site number 44 is the Llamacorral and number 45 is Ishla Ranra, which are outliers of many tests as they are adjacent the Laguna Purhuay. This low-low clustering around Huari was also a statistical cold-spot from the local Getis Gi test, a complimentary result.





Existent Sites in AD1 Local Moran’s I produced only outliers. High-low outliers were present at sites 6 near Santa Cruz, site 47 near Huari, and site 44-45 Llamacorral Ishla Ranra cluster. There were low-high outlier at site 10 near Santa Cruz. There was nothing significant from the local Getis Gi statistic. The Huarás-Recuay set Local Moran’s I produced only outliers as well. Again the 44-45 produced a high-low outlier. Local Getis Gi statistic produced nothing significant.

Local Moran’s I analysis for the Classic Recuay layer produced only High-Low outlier at site number 34 Mashuanco, the local Getis Gi produced no significant clustering. Local I statistics for the Late Recuay showed a high-high cluster along the Río Ancash and a low-low clustering in Huari. There were several high-low outliers including 44-45, as well as sites 34, 30, and 41. Getis Gi local statistics complimented these clusters: there was a hotspot along the Río Ancash and a cold spot in Huari at the 95% significance level.

|  |
| --- |
|  |

The Post Recuay layer contained only outliers spread throughout the dataset. High-low outliers were visible in Huari at sites 30 and 12, Huaraz at site 28, and site 26 near Santa Cruz. Low-high outliers were also present in Huaraz site 24 and Huari site 35. Local Getis Gi produced no significant hot or cold spots in the data.

**Discussion of Trial 2**

Interestingly Trial 2 revealed sites 30, 34, 41, and the Purhuay sites 44-45 were persistent outliers in the local tests. Site 30 Pan de Azucar was an outlier in the Recuay Dataset, the Late Recuay, and the Post Recuay. Site 34 Mashuanco was also an outlier in the Recuay Dataset and the Late Recuay. Site 41 Ogupampa was an outlier in the Recuay Dataset and in the Late Recuay. Sites 30, 34, and 41 all were isolated sites with a single individual buried in them. The fact these sites were persistent outliers in the second trial could imply these sites were truly outliers in all eras.

I had hoped this trial might allow me to distinguish residential versus mortuary areas, but it appears this is not the right way to approach the question. Part of the problem was the presence of so many sites with few burials present within them. The Recuay dataset includes many isolated burials, caves, and single-use monuments but relatively few larger multi-chullpa sites. If there is a way to calculate the mortuary districts, it is likely to be at a more local level. Because each site had a value of either one or zero, Trial 2 did not allow for assessments of large versus small scale mortuary complexes. Thus the many small sites did have the same value as larger sites with far more burials present.

Finally Trial 2 was susceptible to many extraneous factors. The highland climate can destroy or preserve mortuary materials in any contexts. Similarly many of these mortuary sites have been opened and looted in the past centuries. Ideally we would have a dataset of all the burials present or looted based on site or monument typology. Only sometimes is such a determination even possible given the data presented in the Recuay Dataset. At the present it remains unclear whether this type of trial would be beneficial even if such modifications were made.

**Trial 3**

Trial 3 tested the Ceramic\_Num variable which indicated presence or absence of ceramic material at a given site. This test was designed to show patterns in the regional ceramic distribution.

**Table 5.3: Trial 3 Binary Ceramic Global Statistics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test** | **Test Statistic** | **Z-Score** | **P-Value** | **Interpretation** |
| Recuay Dataset | I=0.243520 | Z=2.597638 | P=0.009387 | Significant slightly positive autocorrelation |
| Recuay Dataset | Gi=0.022625 | Z=1.382472 | P=0.0022625 | Significant hotspot clustering |
| Classic Recuay | I= 0.236909 | Z= 2.084085 | P=0.037152 | Significant slightly positive autocorrelation |
| Classic Recuay | Gi=0.033478 | Z=0.602661 | P=0.546734 | Insignificant hotspot clustering |
| Late Recuay | I=0.304899 | Z=3.204363 | P=0.001354 | Significant slightly positive autocorrelation |
| Late Recuay | Gi=0.024980 | Z=1.895379 | P=0.058042 | Hotspot clustering on the cusp of significance |

The Recuay dataset produced a globally significant autocorrelation but a Gi value not distinct from random. This assessment was continued into the Classic Recuay dataset. The same is true of the Late Recuay, but the Gi value produced a P-value of 0.058 so the data on the cusp of statistical significance. Thus all three tests showed globally significant autocorrelation but only one showed nearly significant hotspots.

Local statistics for the Recuay dataset showed a high-high clustering in Huari and a low-low clustering in Santa Cruz. High-low outliers were north of the Santa Cruz cluster at sites 5, 7, and 8. There was also a low-high outlier at Huaraz. Local Getis Gi complimented the I values showing a hotspot in the Huari locality and the coldspot near Santa Cruz.

Similarly the Existent Sties in AD1 showed a high-high clustering in Huari, a high-low outlier in site 42, and sites 44-45 Laguna Purhuay. Santa Cruz only showed a series of outliers: a high-low outlier at site 6 and a low-high outlier at site 10. Local Getis Gi complimented the I statistics as the Huari clustering is a coldspot at the 95% confidence level. Local statistics for the Huarás layer produced only an outlier at the Laguna Purhuay sites 44-45. Getis Gi showed these sites and site 33 in Huari as coldspots.

Local statistics on the Classic Recuay layer showed significant low-low clustering in Santa Cruz with high-low outliers to the north at sites 1,5,6, and 8. A single low-high outlier was present at site 25 in Huaraz. Getis Gi complimented these results showing coldspots around Santa Cruz at the 95% confidence. Isolated hotspots were also identified at site 21 in Huaraz as well as at 30 and 35 in Huari.

Local Stats in the Late Recuay showed significant low-low clustering in Santa Cruz and a high-high clustering in the south of Huari. North of Santa Cruz were high-low outliers at sites 5,7, and 8. Getis Gi complimented, albeit dubiously significant. There was a visible coldspot in Santa Cruz and a hotspot in Huari. There were also a few isolated hotspots north of Huaraz and on the Río Ancash. Post Recuay produced only a single low-high outlier at Santa Cruz number 10. There was no significant hot or cold spots from the local Getis Gi.

**Discussion of Trial 3**

There are several recurrent outliers, most importantly sites 5 Parian Punta and 8 Wayumarca both of which were high-low outliers for the Recuay dataset, the Classic Recuay, and the Late Recuay. Site 7 Cruz Punta was also a high-low outlier for the Recuay dataset and the Late Recuay. Sites 44-45 the Laguna Purhuay locality were also high-low outliers but only in the Existent Sites in AD1 trial. Interestingly site 10 Pariamarca was a low-high outlier for the Existent Sites in AD1 and the Post Recuay only.

Taken together, the global and local statistics show clearly that there is a meaningful clustering around Huari and Santa Cruz with many outliers all across the sample space. The tests for autocorrelation showed that these local results are distinct from random chance. Trial 3 tests tended to complement one another well. High-high clustering in Huari and low-low clustering in Santa Cruz were complemented with Gi hotspots in Huari and coldspots in Santa Cruz. These trends are embedded in these data.

Sites 5, 7, and 8 all contained ceramics but many nearby sites recorded no ceramics at all. Site 44 Llamacorral did not contain ceramics while site 45 Ishla Ranra did. These sites are immediately adjacent one another, so the question becomes why was the Laguna Purhuay locality an outlier only once across Trial 3? Sites 42-49 all contained some ceramics with the sole exception of Llamacorral. It stands to reason that though 44-45 are so close, these other local sites with ceramics might well have overpowered the local outlier. There is only one site in the area which does not have ceramics, so it is an outlier but only sometimes a statistically significant outlier. Thus in several cases these sites must be high-low outliers in context of what values are immediately adjacent these sites.

**Trial 4**

Trial 4 tested the Ceramic\_Type\_Num variable, which was coded as Recuay plainwares, Recuay Fineware, and foreign ceramic materials. Trial 4 was designed to complement Trial 3 in a more sensitive test.

**Table 5.4: Trial 4 Ceramic Type Global Statistics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test** | **Test Statistic** | **Z-Score** | **P-Value** | **Interpretation** |
| Recuay Dataset | I=0.225355 | Z=2.450499 | P=0.014266 | Significant slightly positive autocorrelation |
| Recuay Dataset | Gi=0.023621 | Z=1.436216 | P=0.150941 | Insignificant hotspot clustering |
| Classic Recuay | I=0.416340 | Z=3.543422 | P=0.000395 | Significant positive autocorrelation |
| Classic Recuay | Gi=0.041017 | Z=2.119290 | P=0.034066 | Significant hotspot clustering |
| Late Recuay | I=0.249135 | Z=2.694425 | P=0.007051 | Significant slightly positive autocorrelation |
| Late Recuay | Gi=0.026335 | Z=1.787636 | P=0.073835 | Hotspot clustering on the cusp of significance |

Global statistics for the Recuay dataset produced significant autocorrelation, but insignificant Gi values. By the Classic Recuay both the I and Gi statistics were significant. The Late Recuay contained a significant I value but a Gi value of .074 which is near the cusp of statistical significance. Taken together, the global data indicates that there was significant autocorrelation but only sometimes significant hotspots.

Local clusters included a low-low clustering in Santa Cruz, a high-high clustering in Huaraz with some significant low-high outliers at sites 23 and 24 near Huaraz. 44-45 Llamacorral site and 42 in Huari are also outliers. Local Getis Gi complimented these results with coldspots in Santa Cruz and Huaraz at the 95% significance level.

Local tests on the existent sites in AD1 showed only outliers, high-low at 44-45 and site 42 in Huari, as well as site 6 in Santa Cruz. There was also a low-high outlier at site 10 in Santa Cruz. Local Getis Gi showed no significant hotspot or coldspots. The Huaras layer similarly showed only one high-low outlier at Llamacorral 44-45. Complimentary there was a coldspot at the laguna Purhuay.

Local statistics on the Classic Recuay showed high-high clustering in Huari and Huaraz, with a high-low outlier at site 39 in Huari. There was a low-low cluster near Santa Cruz with high-low outliers along the periphery at sites 15, 6, and 3. There was a high-low outlier at site 18 along the Río Ancash. Getis Gi complimented the results showing a coldspot in Santa Cruz and a hotspot near Huaraz at the 95% confidence level.

Local tests in the Late Recuay dataset showed low-low clustering in Santa Cruz, with high-low outliers n the north. Huaráz exhibited a high cluster with sites 23 and 28 as low-high outliers. At Huari there was a low-low cluster in the 44-45 Llamacorral site. Getis Gi values corroborate with hotspots in Huaráz and coldspots at Santa Crux at the 95% significance level. Finally the post Recuay era showed only a single low-high outlier at site 10 in Santa Cruz. Local Getis Gi showed nothing significant.

**Discussion of Trial 4**

Local low-low clusters existed in Santa Cruz for the Recuay dataset, Classic Recuay, and Late Recuay. There was high-high clustering in Huaraz for the Recuay dataset, Classic Recuay, and a smaller cluster in the Late Recuay. There was high-high clustering in Huari also in the Classic Recuay. Throughout the dataset Santa Cruz exhibited Gi coldspots as well during the Recuay dataset, Classic Recuay, and Late Recuay eras. Conversely Huaraz was a Gi hotspot near Huaraz in the Classic Recuay and Post Recuay eras.

There were also some outliers such as site 23 Quitapampa B which was a low-high cluster for the Recuay dataset and Late Recuay. This site contained a Moche ceramic, and thus the foreign fineware represents an outlier from local Recuay wares found at nearby sites. Another outlier was site 6 Hualcayan which was a high-low outlier in the Existent Sites in AD1 and the Classic Recuay. Hualcayan contained local Recuay Kaolin fineware but no foreign materials. Site 42 Chuncayajirca 2 had only Local Recuay plainware but was statistically significant in the Recuay Dataset and in the Existent Sites in AD1. Site 42 was not significant in any of the later trials, so it seems the site was an outlier only when looking at the entire dataset.

One final significant outlier was the locality of 44-45 near Laguna Purhuay. The Recuay dataset and the Existent Sites in AD1 subset both showed this locality as a high-low outlier, but the Late Recuay era showed only low-low clustering. This variance could be due to the fact that no ceramics were documented at site 44 Llamacorral while site 45 Ishla Ranra contained only local Recuay ceramics. On a scale from 0-3, these values are both at the low end. So it seems that the subset of the Recuay Dataset used in a given trial played a role in determining the relative significance of the locality.

Trial 4 produced low-low clustering around Santa Cruz on several of the tests. This was also true in Trial 3 where the same area was a low-low cluster. The sites near Huaraz showed consistently high-high clustering. Nearly all of these sites contained ceramics, but a fair number included fineware and two had foreign Moche materials. As such it makes sense this could be a hotspot or cluster in several of the tests for Trial 4 but not in Trial 3. Trial 3 coded all ceramics in the same way, so presence of fineware or foreign ware has no greater pull than presence of plainware. In Trial 4 the significance of such a concentration of fineware is enough to consistently produce a high-high cluster where in Trial 3 these sites only produced outliers.

This trend is flipped for the sites around Huari. Sites near Huari were in the Ibarra dataset and almost all of these sites did have ceramics present. Mostly these are Recuay plainware or otherwise nondiagnostic ceramics. This means that most of the sites had a value of 1 or “present” in Trial 3, but most kept values of 1 or “Local Recuay” for Trial 4. In Trial 3 there was an area of high-high clustering and hotspots among these sites, while in Trial 4 the abundance of mainly plainware produced only outliers. The abundance of plainware made the area a cluster for Trial 3, but produced only outliers on Trial 4.

**Analysis Trial 5**

Trial 5 tested the Metal\_Num variable of presence or absence of metal artifacts at a site. Given the lack of specificity about types and styles of metalworking in the various site reports as to type or style, there can be no complementary assessment of a type or style. Some of the authors focused on metalworking as a portion of their analysis while others noted simply metal’s presence or absence at a site. Ponte’s sites had a tally of metal and types while Ibarra had a check for presence. This test was not sensitive to quantity of metalwork merely their presence.

**Table 5.5: Trial 5 Binary Metalwork Global Statistics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test** | **Test Statistic** | **Z-Score** | **P-Value** | **Interpretation** |
| Recuay Dataset | I=0.462331 | Z=4.861910 | P=0.000001 | Significant positive autocorrelation |
| Recuay Dataset | Gi=0.065857 | Z=4.326386 | P=0.000015 | Significant hotspot clustering |
| Classic Recuay | I=0.348017 | Z=3.084549 | P=0.002039 | Significant positive autocorrelation |
| Classic Recuay | Gi=0.084501 | Z=2.563004 | P=0.010377 | Significant hotspot clustering |
| Late Recuay | I=0.538277 | Z=5.651898 | P=0.00 | Significant positive autocorrelation |
| Late Recuay | Gi=0.083341 | Z=5.065333 | P=0.00 | Significant hotspot clustering |

The Recuay dataset produced both global statistics as different from random. This was also true for the Classic Recuay and the Late Recuay subset. Together this means that all through the Recuay era these data are both meaningfully autocorrelated and also have significant hotspots.

Local tests on the Recuay dataset showed a low-low clustering in Huari and at Santa Cruz. Huaraz showed high-high clustering as well. Local Getis Gi values complimented these results with a cold spot in Huari and a hotspot in Huaraz at both the 95 and 99% significance. There was a weaker cold spot at Caraz near Santa Cruz.

Local tests on the existent sites in AD1 showed only outliers, both in Santa Cruz. There was a high-low outlier at number six and a low-high outlier at number 10. Local Getis Gi values showed a cold spot in Huari and a hotspot including site number 10. The local statistics could not be run on the Huarás Recuay layer because all the values in the Huarás layer contained no metal. As such all the sites were coded as zeroes and no meaningful clustering or hotspots are statistically possible.

The local Moran’s I showed a low-low cluster in Santa Cruz and a high-high clustering in Huaraz. Sites 21 and 22 near Huaraz were low-high outliers and site 6 near Santa Cruz was a high-low outlier. Getis Gi complimented these results showing hotspots at Huaraz into the 99% confidence level, and a coldspot at Santa Cruz at the 95% level.

Local statistics were calculated showing low-low clustering in Huari and high-high clustering in Huaraz. There was an low-high outlier at site 23 near Huaraz. Getis Gi complimented these results well showing a coldspot in Huari and a hotspot in Huaraz at the 95 and 99% confidence levels. There was a single site at number 17 near Santa Cruz which was a coldspot at the 90%. Global statistics for trial 5 showed significant autocorrelation and extreme value clusters. Local tests were generally complimentary.

**Discussion Trial 5**

There were several outliers in Trial 5. Significantly Site 6 Hualcayan was a high-low outlier in the Late Recuay. In the Classic Recuay era sites 21 Ama and 22 Quitapampa A were in a high-low cluster. These two sites are near one another, and each of them contained some metalwork. Thus these two sites are clustered as outliers.

These trends make some sense as the Ibarra portions of the dataset from Huari only contained sparse metalwork. At the same time seven out of ten of the Ponte sites near Huaraz had some metalwork. Huaraz was a high-high clustering in all eras. The raw data shows a relative abundance of metalwork throughout the entire trial. At the same time the sites around Santa Cruz only had a few pieces of metalwork across all the sites.

The main result of Trial 5 is that there were significant results in every global test. This indicates that these clusters and outliers are meaningful based on the datasets. Part of this could be due to the clustering in the dataset itself. Many sites in Huari had no metalwork, so it is a distinct coldspot in the dataset. On the other hand the sites near Huaraz had a majority of sites with metalwork, so it is a hotspot in the dataset.

It is possible this is the result of how the sites were documented. Many sites had no metalwork at all and those that did tended to be clustered in the Huaraz area of the Ponte dataset. The official forms indicate that metalwork should be noted whenever present in the formal documentation of the sites. Thus there should be no discrepancy between where metalworking was found and this Recuay dataset. At the present I have no means of testing this and can only work based off these published materials.

As stated above many of these sites have been looted prior to documentation. Metalwork is valued not only for sale as stolen artifacts, but also as a purely practical material. Metal artifacts can be melted and reformed to suit the needs of any successors be they of the same culture, a later culture, a colonial master, or modern agriculturalists who have some need. At the present I have no means of testing whether there was significant destruction or removal of materials between the time of deposition and the time of documentation.

Finally there is a very real possibility that the sites near Huaraz simply did have more metalwork than the other localities. The sites from Ibarra near Huari and the sites in the Mariñón from Barbosa were noted as being Recuay hinterlands. These sites are outside of the main Callejón and therefore the various trade networks which allowed it to flourish. Although the sites near Huaraz are in the upper Rio Santa, they are still in the Callejón and the Classic Recuay Heartland. It does make some sense that these sites would have more metalwork than sites farther afield.

At the same time, the Bria points around Santa Cruz are far closer to the Recuay heartland than even the sites near Huaraz. Despite their propinquity to the great heartlands, there were only a few sites with any documented metalwork. This could be due to differential preservation. The larger sites which were documented more intensively were themselves closer to the modern cities. Both Huaraz and Santa Cruz are today fairly large so significant disturbances to these sites in the past and present seems likely.

**Trial 6**

Trial 6 ran the Moran’s I and Getis’ Gi on the MNI variable. As with Trial 2 the goal was to find clustering of sites with respect to mortuary monuments. This test was sensitive to the size of the site, as number of individuals was a counting number. Absence of mortuary material was a value of 0, just like in Trial 2.

**Table 5.6: Trial 6 Burial MNI Global Statistics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test** | **Test Statistic** | **Z-Score** | **P-Value** | **Interpretation** |
| Recuay Dataset | I=0.006486 | Z=0.381770 | P=0.702632 | Insignificant autocorrelation random clustering |
| Recuay Dataset | Gi=0.023217 | Z=0.072228 | P=0.942421 | Insignificant hotspot clustering |
| Classic Recuay | I= -0.017189 | Z=0.390948 | P=0.695836 | Insignificant autocorrelation random clustering |
| Classic Recuay | Gi=0.015810 | Z= -0.450429 | P=0.652401 | Insignificant hotspot clustering |
| Late Recuay | I=0.001522 | Z=0.330361 | P=0.741127 | Insignificant autocorrelation Random clustering |
| Late Recuay | Gi=0.018013 | Z= -0.115273 | P=0.908229 | Insignificant hotspot clustering |

The Recuay dataset produced neither I nor Gi statistic as significantly different from random. This was also true for the Classic Recuay era and for the Late Recuay. As with Trial 2 this would imply that local clusters are the only means of getting a meaningful point scatter. Unlike Trial 2 these local tests produced clusters and hotspots beyond outliers.

Local tests on the Recuay dataset showed low-low clustering in Santa Cruz with high-low outlier at number 6 and low-high outlier at number 7. There was also high-high clustering at Huaraz. There was significant low-low clustering in Huari at the Laguna Purhuay sites 44-45. Getis Gi produced only a single hotspot in Santa Cruz only at the 90% level. The Existent sites in AD1 showed only outliers at Santa Cruz. There was a high-low outlier at number 6 and a low-high outlier at number 10. Getis gi showed a hotspot in Santa Cruz as well.

Huarás Recuay local Moran’s I produced only outliers. There was a low-high outlier at site 33 and a high-low outlier at sites the Laguna Purhuay sites 44-45. Local Getis Gi test showed nothing significant. In the Late Recuay Local Moran’s I showed only outliers in Santa Cruz, a high-low outlier at number 6 and a low-high outlier at number 7. In Huaraz there was another high-low outlier at site 28. Local Getis Gi showed nothing significant.

**Discussion Trial 6**

Local tests on the Recuay Dataset showed low-low clustering in the Bria points near Santa Cruz and a high-high clustering in the Ponte sites near Huaraz. The 44-45 Purhuay locality was also a low-low cluster. The Bria points were also a hotspot, but only at the 90% significance level. The AD1 and Huaras Recuay datasets also produced only outliers. In the Classic Recuay era the same Bria points produced low-low clustering but there was a hotspot in the same area. By the Late Recuay era only outliers existed in the entire dataset.

These results show that during the Classic and Late Recuay held significant low-low clustering in the points near Santa Cruz throughout the dataset. This makes some sense as there were relatively few sites which had any human materials identified at all. This locality should be a clustering of points with low values based solely on the datasheet, but with an outlier at site 6.

The outlier came up consistently was site 6 Hualcayan from the Bria dataset. Site 6 was an outlier in the Recuay Dataset, the Existent Sites, the Classic Recuay, and the Late Recuay. Site 6 was an important site throughout the Recuay era, with a significant mortuary complex to match. Because of this site’s significance it was the main point of her work and had far more detail than any of the other sites she documented near Santa Cruz. Critically it is the only point in the Bria dataset with a high MNI of 129. This means that the site could be an outlier principally because it was the site which was studied most intensively in that project.

The difficulty with Trial 6 and site number 6 is whether it is an outlier because there were so few points in the Bria dataset with mortuary contexts, rather than a true outlier. Based on the trial 6 it is clear that something is going on at Hualcayan. Several of the tests including the Recuay Dataset and the Late Recuay showed a low high outlier between sites 6 Hualcayan and 7 Cruz Punta. Site 7 had an MNI of 0 opposite site 6 MNI of 129. Though Bria made it clear Hualcayan is a significant site, trial 6 leaves the site in ambiguity.

Trial 6 was overall directed to complement Trial 2. While Trial 2 only produced outliers, Trial 6 produced clusters and outliers. On the other hand none of the Global statistics were never significant at the .05 level. This is not inherently a problem as the Global metrics are designed to test the whole dataset and the Local are designed for subsets. In neither trials were the Global statistics sensitive or significant. This does not mean the local clusters are insignificant but it could mean that the datasets are not clustered as a whole. This could imply that the more specific the subset the more detailed the results. Conversely this could also imply that these local clusters are only significant because of the subset they are in.

Of course there is also the possibility that the mere presence of sites so different as Hualcayan and Cruz Punta might actually be artificially creating clusters like the 44-45 Laguna Purhuay. This does explain the outliers, but it does not make them insignificant. Cruz Punta was a residential site. The Recuay tended to live adjacent their mortuary monuments, but only rarely are remains found inside residential areas. Hualcayan was a site with a mortuary mound and patio. It is possible that the sites actually are a mortuary and a residential sectors that the test did identify as outliers. This implies that the basic binary variable in Trial 2 was insufficient at identifying such relations while the MNI variable in Trial 6 was able to.

**Qualitative Analysis of the Spread of the Chullpa**

One of the chief goals of this project was an assessment of the spread of the Wari and its cultural material into the highlands through this same dataset. At first I had intended to run a clustering on the data and maybe other tests as well. But I found that even the presence of Chullpas was very dispersed across the dataset and therefore difficult to assess.

I did run the usual Global and Local four test trial on the Classic Recuay for number of Chullpas variable. Both the Global I and Gi values were significant at the .05 level, but the local tests showed only a high-high cluster around the Río Ancash (which was also the only statistically significant local hotspot. In all these tests were not terribly informative or demonstrative.

I decided to change the way I was thinking about the Chullpa presence to one of qualitative trends across eras. The spread of the Chullpa was visible throughout the Recuay era by a series of thematic maps across time. Using the same periods and the same definition-queried layers as before now showing the presence of Chullpas and a breakdown of mortuary monument.

The Existent Sites in AD1 layer showed only two sites with Chullpas, Hualcayan and Ishla Ranra. Neither of these sites actually had Chullpas in AD 1, they were simply sites occupied in AD 1 that would be occupied long enough to contain Chullpas. The Huarás-Recuay layer showed the same Ishla Ranra site as its sole presence of a Chullpa. Together these sites indicate that most of the Recuay and Huarás sites at the beginning of the Early Intermediate Period would not persist through the arrival of the Chullpa. This is reasonable as many of the sites were single burials, small residential, and small agricultural sites.

By the Classic Recuay era there was a fair distribution of sites in the Santa Cruz region which contained Chullpas. All three of the sites in the Río Ancash contained Chullpas. It seems the Chullpa was adopted comparatively early. Significantly during the Classic era there were no Chullpas present in either the sites near Huaraz or Huari. The Classic Recuay era was a time when the Wari were beginning their expansion, though not yet into Ancash directly. It was when the very first aspects of their bundle appeared in the highlands. Finding some Chullpas in those sites closest to the central Callejón heartland and along trade routes were the expected results.

Map

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**Map 5.XX Chullpas present during the Classic Recuay Era**

During the Late Recuay era there were even more Chullpas present wider than during the Classic. This era corresponds to the Chullpa appearing in full force to the highlands. There are even more sites near Santa Cruz with Chullpas present, and all three of the Río Ancash sites were still being used at this time. Significantly the sites of Ishla Ránra and Ushnu de Cajay near Huari contained Chullpas. The Late Recuay corresponds to the Wari expansion. During this phase the Recuay world transitions towards the Wari sequence. These Chullpas present in greater numbers of sites and in greater geographical distribution of sites is the expected result which reinforces the pre-published trends. **Map 5.xx** By the Post-Recuay era there were far fewer sites still occupied. About half of those that were still being used contained Chullpas.

Map

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**Map 5.xx Chullpas Present in the Late Recuay Era**

Together these descriptions of the data show well the spread of the Chullpas through the Recuay era. Early on there were no Chullpas, but only some few large and important sites saw continued use long enough for Chullpas to be built. During the Classic era there are far more sites with Chullpas but they have a heightened concentration nearest the heartland in Santa Cruz and the Río Ancash. Then during the Late Recuay there is a surge of Chullpa building. The Wari Bundle is being absorbed and adopted fully into the local traditions. There are noticeably more sites with Chullpas present, and these sites are over a wider distribution in the highlands. By the Post-Recuay only a few sites remained in use, but those who did often contained Chullpas.

In addition to this basic discussion of Chullpas present at sites over time, the data was built to allow comparison across eras of various mortuary types. Again statistical clustering and regression produced less meaningful results than I had been anticipating, so I decided to move through a more qualitative approach. The most straightforward way to approach this was to symbolize points as pie-charts showing the breakdown of mortuary treatments present at sites across the various eras.

Those sites existent in AD1 contained primarily subterranean mortuary treatment. There were some platforms as well. Again Ishla Ranra and Hualcayan contained Chullpas from a later phase of their occupations. Most importantly all sites except Hualcayan contained only one type of mortuary treatment per site. Hualcayan contained some subterranean and Chullpas.

By the Classic Recuay era the sites around Huaraz contained single type burials. There was one cave burial and the remainder of these sites were subterranean. Similarly around Huari there were only single subterranean and platform types. There were absolutely no Chullpas present in either area until the Late Recuay, a result that compliments well the prior discussion. Those sites near the Río Ancash contained a mixture of mortuary types. There were some Chullpas present in all three sites, and a combination of Subterranean and caves. This region had two sites with multiple mortuary treatments.

Around Santa Cruz there is an interesting trend. Most of the sites are single type: subterranean or Chullpa. There are also several sites with multiple treatments usually platform or subterranean with Chullpas present. This trend shows how significant the Chullpa became during the classic era. Given the Santa Cruz area was occupied most intensively throughout eras of any of the regions discussed, it makes sense that there would be a higher volume and variety of mortuary types. These sites are closest to the heartland and the major cultural transformations occurring there.

Taken together the Classic Recuay was an era where Chullpas were appearing more frequently in Ancash. This change was felt most intensely in the northern areas with denser population and a higher proximity to the heartland. The presence of Chullpas at sites with previous mortuary usage further reinforces Recuay ancestor veneration. Around Santa Cruz the change is stark. There are many sites with only subterranean burials and only Chullpas, and there are some with overlap. In this region it seems the Chullpa facilitated the shift from the traditional entombment to the more accessible ancestor.

Map

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**Map 5.xx Classic Recuay Monuments Map 5.xx Classic Recuay Monuments   
around Santa Cruz. Around the Río Ancash**

Map

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Description automatically generated with medium confidence

**Map 5.xx Classic Recuay Monuments Map 5.xx Classic Recuay Monuments  
around Huaraz around Huari**

During the Late Recuay era there is a continuation of the trends observed in the Classic. Around Huaraz there are no Chullpas but only subterranean burials in the Late Recuay era. Around Huari the first Chullpas appear, but they are sparse and only visible at two sites. The three sites in the Río Ancash showed no change since the Classic, they are the same three points after all. Around Santa Cruz the same trend continued as the Classic, but there are a few new sites with only Chullpa burials from the Late Recuay era.

Map

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**Map 5.xx Late Recuay monuments around Santa Cruz**

Graphical user interface, text

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**Map 5.xx Late Recuay Monuments around the Río Ancash**

Map

Description automatically generatedMap

Description automatically generated

**Map 5.xx Late Recuay Monuments Map 5.xx Late Recuay Monuments around  
around Huaraz Huari**

Ultimately these trends are visible without additional computation. Chullpas originated during the late Classical Recuay and continued through the Late and Post Recuay eras. Though the Chullpa is associated with the arrival of the Wari Bundle, it does not overpower the Recuay until much later. Nonetheless there is a clear visible trend showing the spread of the Chullpa across the highlands throughout the Recuay sequence.

**Discussion**

**Discussion of Global Significance**

There are several trials in the dataset which were consistently statistically significant across the trials, and several which were consistently insignificant across trials. The biggest part of this seems to be the relative dispersal of the dataset. Global tests assess trends across the dataset, but may not be sensitive to local outliers. As there are many outliers spread all throughout the data, the global tests varied in their relative statistical significance. This does not mean that the local clusters and hotspots are not valid, just that there are enough outliers to overwhelm the global test, there are too many directions the data is being pulled.

In the Recuay Dataset global tests for both hotspots and autocorrelation were not statistically distinct from random on trials 2 and 6. But the Recuay Dataset produced statistically distinct from random Moran’s I but not Getis’ Gi on Trials 3 and 4. Both Moran’s I and Getis’ Gi were both shown to be significant for the Recuay Dataset on Trial 5.

The Classic Recuay dataset global tests for hotspots and autocorrelation were not statistically distinct from random on Trials 2 and 6. But the Classic Recuay dataset produced statistically meaningful test of global autocorrelation but not significant hotspots in trial 3. Both Moran’s I and Getis’ Gi were significant for the Classic Recuay dataset on trial 4, 5

In the Late Recuay global statistics for Moran’s I and Getis Gi were insignificant for Trials 2 and 6. But the Late Recuay Trial 3 produced a statistically significant Moran’s I but the Getis’ Gi was at P= 0.058 implying it is at the cusp of statistical significance. Trial 4 produced the same result with the Getis’ Gi at P=0.074. In the Late Recuay Trial 5 produced statistically significant results for both global Moran’s I and Getis’ Gi.

Though there were locally significant points in all these trials, the global statistics for 2 and 6 were never significant. Trial 2 was the presence or absence of any burial material, and Trial 6 was the test on the number of individuals in each site.

It could be that there was an issue in how I conseptualised the variables for the datasets. I had thought there would be a way to identify mortuary versus non-mortuary sites from the presence and volume of burial material present. But as all global tests showed there were no patterns of autocorrelation or hotspots globally valid in any trial. I am not certain exactly what this means at the moment.

A part of the problem could be that many sites were both mortuary and residential. If the goal is to assess mortuary complexes as separate from residential, then the dataset would need to be more sensitive than that. These sites would have to be documented as separate entities, and quite often in the site reports and papers they are not. This means that in Trial 2 a huge site with many burials such as site 6 Hualcayan and a site like site 25 Ama II A which had only one were represented in these global statistics as the same value.

Even when the MNI was used in Trial 6, the dataset still is not sensitive enough to identify mortuary and residential as separate entities. In addition the same large sites such as Hualcayan are surrounded by sites without any mortuary material at all. This made Hualcayan an outlier in many of the local tests and not a cluster.

In contrast Trials 3, 4, and 5 all had significant global Moran’s I statistics and occasionally significant Getis’ Gi statistics. These trials are on the ceramic number, ceramic type, and metal number variables. The significant global Moran’s I for all datasets indicates that these data are autocorrelated significantly in every trial.

Likely the most important reason for this trend is that presence of ceramic is distributed widely across the dataset. Many sites had ceramics present, and so there is a significant amount of data to draw from. On the other hand, ceramic type was a variable that similarly had many points and different values. Like ceramics metals were also present in several sites all throughout the entire dataset. Unlike the presence of burials which was distributed somewhat unevenly across the dataset, presence of status goods are found across the dataset. This distribution is significant enough to be more than random, but also indicating clear clustering in the data.

**Discussion of Laguna Purhuay Locality**

Problem with outliers at site 44 and 45. The Llamacorral site is an anomaly built in the lakebed of glacial Laguna Purhuay. At the summit of a cliff is the residential settlement Ishla Ranra built at the top of a cliff. These two sites literally on top of one another separated by mere meters of latitude and longitude but distances in elevation. The two sites were often outliers on one another. I don’t think the results are invalid, they are two distinct sites with distinct attributes, it is logical they are commonly autocorrelated or outliers.

The interesting piece is that the Llamacorral site was always a strange place that confounded researchers, and now it stands as a persistent outlier in this research. Without a doubt the strange site is anomalous in the highlands, but that might be the source of the outlier. In the dataset there were no human remains identified, no ceramics collected, no metalworking found, and no mortuary structures present. There was significant carving on large stones, but the artifacts were otherwise lacking at the site.

Given the lack of cultural material and its location at the national park lakebed, it does make some sense that there would be limited material recovered. Scholars have been studying the site for decades, and before them this Llamacorral site was particularly visible. Most of the Recuay sites are remote hilltop settlements and isolated manifestations on mountains. Llamacorral is very visible and accessible, but it is also held open to the public.

**Discussion of Testable Variables Stratification and Cultural Change**

The principle goal of this project was to identify cultural change and stratification in the Recuay hinterland.

Cultural change was assessed primarily by the volume of foreign ceramic. The original intent was to assess tomb type as well, presuming that Chullpas are evidence for Wari expansion. As the analysis began these values were not numerous enough for the Moran’s I, but presence of Chullpa was used to corroborate the statistical findings.

Stratification was assessed by presence of metal work, the presence of foreign ceramic, and the concentration of ceramics. When the high status individuals died in the Recuay world, they were usually venerated in their tombs and given gifts by their descendants. As such the Recuay left visible signs of status in their graves.

These outliers provide some insight into the structure of the dataset and there are some patterns visible. Most pronounced is that when sites are outliers, they tended to be outliers in different trials. Table 5.7 shows attributes for these persistent outliers. Many of these showed sites with a strong pull for several variables, such as Site 06 Hualcayan, 07 Cruz Punta, 21 Amá, 22 Quitapampa A, and 45 Ishla Ranra. These sites are likely very significant places on the landscape, local cores as it were, where a combination of attributes creates a pull across trials and eras.

All of these sites are statistically distinct from nearby sites as documented throughout the trials. Thus these are the sites where a strong argument could be made for local social stratification. Though all these sites are hinterland, it is expected for there to be comparatively wealthier sites throughout the hinterland. These sites tend to show the attributes we would expect; it is in their combinations that they start to look a bit similar. Additionally only three sites contained Chullpas.

Taken together these sites contain combinations of metalwork, ceramic, and burials that indicate wealth present at them. Interestingly only three sites contained Chullpas, implying the Recuay hinterland elite sites only sometimes adopted the Wari bundle as their society was changing. Sites 6 and 7 were dated through AD 1000, indicating they were elite sites during the Recuay era and then continued throughout the entire Wari era. Outlier sites 21 and 22 showed no signs of usage after AD 650 while sites 41, 42, 44, and 45 ceased after AD 700. Viewed in this light adopting the Wari bundle seems to have been an adaptive strategy for some of the sites, either change your culture or your site will not survive.

Conversely site 44 Llamacorral contained no burials, ceramics, metalwork, or mortuary structures, yet it was still an outlier for its propinquity to 45 Ishla Ranra which contained burials and Recuay plainware. The details of this site are discussed above. Both sites were used from the Huarás through the end of the Recuay era in AD 700. Neither contained any Chullpas, indicating they were never able to adopt the Wari bundle. Ishla Ranra is an outlier for what was found there; Llamacorral for what was not found there. Together they provide a pull on each statistical tests that demonstrates well their uniqueness.

**Table 5.7 Attributes for Significant Outliers**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Site Name | Burial Number | Ceramic Number | Ceramic Type Number | Metal Number | MNI | Chullpas |
| 05 Parian Punta | 1 Present | 1 Present | 2 Kaolin | 0 Absent | 0 | 1 |
| 06 Hualcayan | 1 Present | 1 Present | 2 Kaolin | 1 Present | 129 | 2 |
| 07 Cruz Punta | 0 Absent | 1 Present | 3 Foreign Akillpo | 1 Present | 0 | 0 |
| 08 Wayumarca | 1 Present | 1 Present | 1 Recuay Plainware | 0 Absent | 0 | 1 |
| 21 Ama | 1 Present | 1 Present | 3 Foreign Moche | 1 Present | 18 | 0 |
| 22 Quitapampa A | 0 Absent | 1 Present | 2 Recuay Kaolin | 1 Present | 0 | 0 |
| 41 Ogupampa | 1 Present | 0 Absent | 0 Absent | 0 Absent | 10 | 0 |
| 42 Chuncayajirca 2 | 0 Absent | 1 Present | 1 Recuay Plainware | 0 Absent | 0 | 0 |
| 44 Llamacorral | 0 Absent | 0 Absent | 0 Absent | 0 Absent | 0 | 0 |
| 45 Ishla Ranra | 1 Present | 1 Present | 1 Recuay Plainware | 0 Absent | 5 | 0 |

There were some clear trends in the data. Most importantly the sites from Bria near Santa Cruz, Ponte around Huaraz, and Barbosa in the Río Ancash tended to contain more status goods than the sites near Huari. The Sites at Huari contained mostly Recuay plainware with a few instances of fine Kaolin. Not one site in the dataset near Huari contained metalwork. Also of significant was that near Huari only Ushnu de Cajay, which was occupied from AD 600-1200, contained a three Chullpa. Subterranean, Platform, and Cave burials dominated this assemblage.

These trends would imply that the sites near Huari were more isolated from the trade routes which created such diverse assemblages at the other localities. Most of these sites were occupied from 200 BC through around AD 700, which corresponds roughly to Huarás and Recuay eras. But we do not have evidence for occupation of most of these sites past the Late Recuay or beyond.

There can be little doubt that these points around Huari represent a distinct hinterland for the Classic Recuay era. As the Recuay flourished, so too did these hinterlanders. But their interaction with outsiders appears to be much less than those in the Callejón. When there are status ceramics found in Huari, they tend to be Recuay Kaolin fineware not foreign made goods. This interpretation is reinforced by the scarcity of Chullpas, a foreign style of tomb construction focused on elites’ ancestor cults. Once the Recuay were in decline, the Wari didn’t seem to encroach as intensively into the hinterlands of Huari as they did in the Callejón.

From the Ponte points near Huaraz we see similar trends, but it appears less isolated. Seven out of the nine sites contained some metalworking. Two sites contain foreign made Moche fineware while another four contained Recuay made Kaolin. All six represent a higher status burial present in the sites. Similarly to Huari there were no Chullpas present around Huarás. This fits well into the date ranges of the sites: most sites from Ponte were occupied in the Early and Classic Recuay, but only two showed any evidence of use after AD 700. These sites were associated primarily with the Recuay, and neither Huarás nor Wari played as big a role in this region as elsewhere.

These trends imply that Huaraz too were somewhat isolated. These sites are at the upper headwaters of the Río Santa, at the extreme end of the Callejón. It does make sense they would have noticeably more interaction than the sites in Huari because they were far closer. The sites near Huari are on the other side of the Cordillera Blanca, outside the Callejón itself. Thus they are closer the central cores of the Recuay culture and also closer their trade networks during the second half of the first millennia AD.

Nonetheless these points do represent a significantly more connected locality than Huari. This group of Recuay sites were able to produce more Kaolin fineware. They had more ready access to the coastal Moche culture and the status goods they could offer. The date range and lack of Chullpas as burial monuments implies that the Huaraz sites were similarly isolated during the initial Wari expansion into the Callejón.

The Barbosa points in the Río Ancash were fewer than the other localities, but noticeably different as hinterland sites. All three sites had some ceramic material present. Two were Recuay style and one was foreign Akillpo style. There was no metalwork present in any of these sites either. All three sites contained some Chullpas as well, though two were mixed with earlier subterranean and cave burials.

These trends make some sense as the sites were occupied during the Classic, Late, and Post Recuay eras, corresponding to the second half of the first millennia. The Río Ancash is to the north of Huaraz and closer to the Recuay heartland. The relative abundance of status goods shows that the area was far more closely related to the central heartland and the trade networks. These sites seem to have been higher status as well.

The presence of Chullpas indicates that the Río Ancash was expanded into by the Wari. Their cultural bundle seems to have arrived in the area and taken it by storm. A total of 70 Chullpas were located in these sites, as compared with 15 cave burials and 15 subterranean. This relative abundance shows that the Chullpas were adopted in full force in the Río Ancash during the Late Recuay era. Relative to traditional Recuay mortuary treatment, these sites chose the Chullpa as a dominant form of burial. This is significant evidence for cultural change in the Late Recuay era.

The points by Bria around Santa Cruz were somewhat uneven in their distributions. Eleven out of the eighteen sites contained no ceramics at all. Two sites contained Kaolin fineware, and two contained foreign made Akillpo ceramics. Only two sites contained metalworking. On the other hand there were twenty-eight Chullpas, thirty-seven subterranean burials, and two platforms.

The date range for these sites spans the entire first millennia, including before and after the Recuay habitation. Ultimately the dispersed distribution of mortuary types is to be expected during the range of habitation. There are many subterranean burials corresponding to the early and Classic Recuay, and then many Chullpas from the Late and Post-Recuay eras. These sites seem to present a good cross-section of Recuay mortuary contexts from the first millennia.

In terms of cultural change during the Recuay era, these sites may be the best illustration of the dataset. These sites are at the edge of the main heartland, they are all along the Río Santa and nearer the coast than any others. This region was more heavily impacted as the Wari expanded into the Callejón and spread their cultural bundle. Local Recuay people seem to shift from the predominantly subterranean to a predominantly Chullpa system of burial.

Interestingly there are only two platform burials. Discussions of the Chullpa’s adoption throughout the Andes generally emphasizes the need for significant ancestors to be accessible to their descendants. These sites show a significant adoption of the Chullpa, but corresponding ancestor veneration seems to have concurrently changed. Before the Chullpa, the region showed relatively few of the platform burials designed for access to and veneration of the dead. Instead these sites contained a significant abundance of subterranean burials, less accessible and monumental than the platforms. So when Chullpas do make an appearance, it likely corresponds to a change in their ancestor veneration as well as mortuary customs. It could be these Recuay people chose to represent their ancestors as effigies or in Huaca stone and not as accessible *Mallqui* bundles in as significant number until after the Chullpa arrived.

**Conclusion Material**

**I think some of the above discussion could be moved to conclusion, the basic outline**

The purpose of this project were to construct a landscape survey of many Recuay sites throughout the Callejón de Huaylas, test the landscape for evidence of social stratification, and then test for evidence of cultural change. Then inferences are made fitting these hinterland Recuay sites into trends already observed throughout the Recuay world.

The dead are never far from the living in the pre-Hispanic Callejón. From the early Huarás era through the Recuay and into the Wari mortuary complexes are nearby. The dead can be visited, venerated, and made offerings or libation to. The dead are never far away during the early intermediate period. Mortuary treatment included platforms, overhangs, and caves to facilitate visitation to the living.

The dead can be defleshed or buried, but the most important people in any society were preserved. Andes have a rich tradition of mummification and the transformation of the body into a *Mallqui* Effigy bundle. There are many places on the landscape where the dead are lithomorphosed into literal features on the landscape such as unusual boulders or piles of stones. In all cases familial ancestors and cultural heroes are venerated by their living descendants.

Without a doubt the dead occupied a position within living society. Ethnohistorically the mummies of great leaders such as the Inka owned property and retained their palaces. These mummies were kept for display on ceremonial occasions, times when the current Inka needed to establish his line and display his claim to the divine power he possessed. These mummies could be sent on diplomatic missions and aid their descendants in securing the Land of Four Quarters.

In the Recuay era we do not have evidence of the dead as ambassadors, but the dead did act as members of society. Their roles were diverse as they could be guides and aides, but also cause trouble for the living when they were not properly venerated. The dead were used as a means of explaining the landscape around the living. The ambient dangers of life in the highlands came from neglect or improper veneration of their ancestors.

The landscape was constructed to allow inter- and intra-site comparison. There are many mortuary contexts and the focus of this project was comparison. Statistical clustering is a great way to do this comparison because each site becomes a point with attributes that can be tested in sequence. My analysis focused almost entirely on these attributes and changes in their expression and distribution.

There were two testable trends: changes in culture and social stratification. In the Recuay, and indeed the entire pre-Hispanic Andes, these two metrics are used widely when discussing cultures. Social hierarchies tend to be literally built into the mortuary monuments and treatments. Stratification with respect to death and burial may be one of the most archaeologically visible processes in the region. Cultural changes tended to be associated with major shifts in artefacts, architecture, and the arts. Cultural changes can stem from interaction with neighbours through trade routes, conflict, conquest, or (in the case of the Wari) all three over the course of several centuries. Cultural change allows insight into the cultural processes at work in the society at that point.

Stratification was assessed through the presence of status goods. The Recuay had a local type of fineware made of the fine Kaolinite rich clay native to the highlands. Kaolin ceramics formed the basis of stratification arguments. Many Recuay were buried with basic plainware ceramics, so when we find a fineware piece it implies a more significant tomb. Kaolin ceramics are a status marker throughout the Recuay era. During the first half of the first millennia AD there was less trade with any region outside the Callejón than there were before or after this phase. Local prestige goods filled the role of social differentiation.

After AD 500 there was a noteworthy increase in material from outside the Callejón. For the first time since the collapse of Chavín the highlands were enmeshed in a trade network comprising the entire central Andes. Most commonly materials from the coastal Moche culture famous for their finewares were traded to the highlands. Akillpo ceramics were also common.

But the networks stretched far beyond the highlands and coasts. The Recuay were producers of wool, valued across the Andes for use in clothing and tapestry. The highlands produced coca, a crop with mystical properties whose use is documented widely. They acquired access to goods like obsidian which had to travel long distances to reach the Recuay. Ceramics too came from all across the Early Intermediate Period. The Moche were joined by their predecessors Gallinazo and Salinar as well as their contemporaries in Lima and Nasca in producing ceramics imported to the Recuay world.

But the biggest foreign imports came in the form of the Wari cultural bundle. Beginning in the Late Recuay, Wari cultural expressions appeared. Architecturally there are D-shaped patios and Chullpas which mark the arrival of the Wari. The Patios and Chullpas represent a change in mortuary treatment. Chullpas are semi-subterranean but have an accessible door designed for the addition and visitation of the ancestors within. The D-shaped patios are far smaller than the raised platforms and plazas used in prior eras. The ancestors were to be venerated in the Chullpa with offerings and gifts, but the celebrations were more exclusive. The patios were enclosed and could not support the type of communal ancestral veneration of the Recuay era.

Though there were new architectural elements brought into the mortuary custom, the basic principles of ancestor veneration do not seem to have been changed as dramatically. There were already gifts and food brought to tombs all throughout the Recuay era. Ancestors were transformed into stone effigies where they could be still more accessible to the people. Recuay dead and living were entangled for their entire cultural sequence. The Wari bundle reinforced the Recuay mortuary custom even as it fundamentally changed the Recuay way of life.

After AD 800 there are no longer cultural manifestations which can be identified as Recuay. Some places like the Chinchawas site show how local styles could morph into a Wari-inspired ‘warmi’ style. But by this point the Wari bundle has made the entire Central Andes archaeologically similar as they spread.

To properly understand these trends, I decided to focus on a confluence of attributes. Different concentrations of ceramics showed how the four different localities fit into the wider Recuay world. Metalwork also were seen as status goods.

Among the most important tests were the global tests for significance. Sometimes the I or Gi statistic were significant at the .05 level, but most of the time they were not. This is ultimately expected based on the hypothesis that the highland, while never homogeneous, exhibited relatively similar trends throughout the Recuay era.

When the global I statistics are not significant at the .05 it means the data is not clustered by those attributes. The insignificant I statistic indicates that the data is distributed in a way that could be the result of random chance. While this is inconclusive, the null hypothesis of spatially clustered or dispersed data can be rejected. This actually means that the data is not clustered around certain parts of the study area, nor is the data so dispersed that it is given a negative I value. What an insignificant I indicates is that the data is not distinct from a random distribution.

In other types of analysis this rejection of the null hypothesis is conclusive, but with I it only indicates that the data is neither clustered nor dispersed. Each site was built and used by Recuay people, as such the data is categorically not the result of random chance. This becomes visible in the local I tests, which can show smaller clusters pulling the data in different directions. For instance the site at Hualcayán is a significant site with many smaller sites nearby. Frequently in analysis Hualcayán was shown as an autocorrelated cluster even when the Global I showed insignificant autocorrelation.

When there are insignificant Global results but significant local results, it actually shows the homogeneity of the highlands. The Recuay heartland contains the huge and important sites, but in many localities across the Callejón. It would make sense that global autocorrelation could be minimized by the presence of so many sites so far from one another. In the hinterlands the same trend could indicate local Recuay cities contained locally significant attributes, but the presence of so many locally significant sites distributed across the whole study area that pulls the Global tests towards insignificance.

In terms of the hypothesis that the hinterland sites are clustered in a manner similar to those in the heartland, these tests show it well. There is no reason to believe that the sites were built by some centralized government, Recuay sites were usually constructed by the local workers and elites. There should be many smaller cores throughout the hinterland, as there are many significant sites in the central heartland. These sites are the local clusters whose pull makes the global clusters appear random.

## what I’m trying to say is the data could be pulled by significant locally autocorrelated features. We would expect the United States population to be clustered in the megalopolis cities, such as New York and LA, but the presence of dramatically large clusters at opposite ends of the dataset could make the global test give an insignificant I value but significant local cluster.