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# RELIABILITY ASSESSMENT OF SURFACE ARCHAEOLOGIGAL SURVEY RESULTS FROM WESTERN ROUGH CILICIA, TURKEY

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*Surface archaeological data provides a wealth of readily available and easily accessible information about past human behavior and settlement systems. It is important that survey results of surface remains be recorded accurately and provide reliable information for interpretation of regional artifact distributions, density, and variations of the archeological record. A resurvey methodology was developed to assess the reliability of results of the Rough Cilicia Archaeological Survey along the coast of southern Turkey. Analysis employed statistical quantification and an overview of factors effecting reliability of surface survey results. The resulting duplicated documents of the same surface record at different points in time clarifies that a single inspection of a surface provides a possible unrepresentative artifact sample, particularly in plowed contexts.*

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Survey of the ground surface is one of the most common and important types of archaeological methodology. This type of dataset provides a wealth of readily available and easily accessible information about past human behavior and settlement patterns.

Current theoretical trends and methodological improvements have amplified the reliance on this type of data independent of subsurface remains. Surface archaeological remains are logistically and economically easier to obtain than subsurface deposits recovered through excavation and do not damage or destroy the record during acquisition. It is for these reasons that surface archaeological remains are increasingly being utilized as the primary source of data to characterize and identify archaeological resources (Cherry 1983; Dunnell 1992; Dunnell and Dancey 1983; Ebert 1992; Wandsnider and Camilli 1992).

## Survey Data Quality Issues

Collection of surface data, just as excavation theory and methodology over the last century, has produced numerous developments to improve data recovery. It is important with any scientific research that the data be both accurate and reliable. Data quality issues are particularly pertinent to surficial remains because of their increased probability of exposure to spatial pattering disturbances by way of cultural and natural taphonomic processes. If observations of the archaeological record are unreliable or invalid, the interpretations about past human behavior will also be highly inaccurate (Nance 1987, 1981; Wandsnider and Camilli 1992). This study considers the data quality issues of the observations archaeologists make about the record, the archaeological document.

The archaeological document refers to the information derived through observation or survey. The document is the data that comprises a sample of the archaeological record (Wandsnider and Camilli 1992:170). On the other hand, the archaeological record is the empirical reality of surface remains, the total population of materials that could be recorded to comprise the document (Wandsnider and Camilli 1992:170).

Data accuracy relates to the actual value and the measured value. With archaeological data it is impossible to have a completely accurate documented value because of the characteristics of archaeological material. All archaeological materials are not preserved and integrity and

provenience are often compromised, particularly with surface remains. However, we can test and account for biases in the data collection methodology. This will lead to a more definitive archaeological document.

Reliability refers to the variation of multiple measurements made about the same data set. Assessing reliability involves estimating the consistency of results (Nance 1987; Wandsnider and Camilli 1992). Reliability is easier than accuracy to test with archaeological documentation because the record can be measured again and again, producing duplicated documents (Cherry 1983). The specifics of the record deposited does not matter in this case, only the document that is written about the record by archaeologists.

It has been suggested by others working in the Mediterranean region that an accurate depiction of the archaeological record requires resurvey or replicated survey visits as a means of checking the consistency of patterns obtained from survey work (Ammerman 1995). Modern cultural land modifications and natural taphonomic processes are at work on the distribution and visibility of archaeological materials on the surface. Therefore, single observations of archaeological surfaces can be insufficient in understanding the entire nature of the record. Reliability is a major issue of survey results of single observations. In many regions, resurvey of areas previously collected in plowed contexts demonstrates the inadequacy of single inspections (Barker 1995; Dunnell 1988; Shott 1995). Others also suggest that the quality of survey data is often taken for granted, potential biases in data and reliability issues are often ignored (Cherry 1983; Nance 1987; Wandsnider and Camilli 1992).

Many comment of survey accuracy have involved controlled studies in which artifact densities, quantities, and conditions were controlled. Although useful, the correlation to the dynamics of actual archeological deposits can be faulty. Taking into account suggestions of assessing data quality of surface survey data, a resurvey method was developed for the Rough Cilicia Archaeological Survey Project (RCSP). During the 2000 season, 12 survey units originally surveyed in 1998 were chosen for an assessment of the archaeological documents written for each survey episode.

The results will lead to proposed improvements to survey strategy that will address accuracy and reliability for the RCSP and beyond. Several factors that have impacts on accuracy and reliability of survey results will also be discussed. These include the characteristics of the archaeological materials themselves, individual surveyor biases, survey sampling strategy, modern land modifications, formation processes, etc. Our interpretations about the past are based upon the data collected in the field and it is crucial that issues of data quality be addressed to ensure that they are reliable. Subsequent interpretations of the past are only as reliable as the data from which they are based.

## Project Background

The Rough Cilicia Archaeological Survey Project is an excellent example of regional survey strategy interpreting the human-land system through a landscape approach, relying heavily upon surface data as the primary source of information. This strategy appreciates the archaeological record as a continuous distribution across the landscape with varying degrees of artifact density (Dunnell and Dancey 1983). Taking this into account, the RCSP records data for the entire landscape, not just those high-artifact density areas that traditionally receive attention. Unlike many archaeological surveys in the Mediterranean region, the RCSP is not interested in recording and differentiating "sites" from background noise. Rather, survey is concentrated on interpreting the distribution of artifact density. The regional scale of the survey emphasizes that past human behavior is best studied through consideration of spatial relationships among many locations, a siteless approach to the entire landscape.

The area of Rough Cilicia is located on the southern coastal portion of modern Turkey (Figure 1). The rough terrain along the Mediterranean Sea has been the setting of a rich archaeological deposit and witness to interactions with other areas of the Mediterranean World, spanning Hellenistic, Roman, and Byzantine time periods. Previous work, by this project and others, has focused on locating and recording several urban areas reported in historical documents and others that contain substantial architectural features (Blanton 2000). Nearly every major hilltop in the area has evidence of ancient occupation including fortifications, cisterns, domestic and public architecture, terraces, aqueducts, etc. However, little is known about the local rural history of the area and the rural relationships with the located architecturally rich areas. The RCSP indents to fill these information voids. Additionally, the project is researching the role the rural landscape played in interactions with other locations of the Mediterranean world.

The intent of initial RSCP survey examination is to ascertain the nature of the archaeological record, in and around urban settlements as well as areas that do not apparently have any substantial clusters of artifacts. Using this regional landscape approach, the project intends to expand away from architecturally rich deposits to acquire data about local rural history of the area. This research design takes advantage of one of surface surveys greatest strengths, as seen according to Cherry, the ability to highlight the rural component of settlement patterns (1983). Therefore, a non-site approach of collecting data of surface artifact distributions and variations is ideal.

***Survey Conditions***

Results of surface survey are strongly dependent upon surface visibility. Whereby, low surface visibility inhibits the identification of archaeological remains (Ammerman 1995; Wandsnider and Camilli 1992). Density measures for areas with good visibility have stronger levels of confidence in the results than areas of poor visibility (Gallant 1986). Assuming artifacts located in areas of good visibility will more likely be encountered. However, the level of impact from surface visibility can be exaggerated to assume that major portions of the record can go undetected (Davis and Sutton 1995). Regardless, this study attempts to determine the role of local surface visibility dynamics in the Rough Cilicia region.

There are several different land cover conditions that have their own unique affects upon the surface visibility. In the Rough Cilicia region, every parcel of land without highly steep slopes, a rocky soil matrix, or overgrown with thick vegetation, is planted with a winter wheat crop. During the time that survey is conducted, in late summer, the fields are clear. Visibility, therefore, is essentially 100%. Agricultural fields are subject to two yearly plowing episodes, which can affect survey results by sampling the artifacts within the plow zone. Each tillage event in a sense churns up a new surface assemblage.

Areas not under cultivation are covered with a thick shrub and thorn cover called Maquis vegetation, which is found throughout the Mediterranean region. This creates unfavorable conditions for artifact recovery. Surface visibility is low and the thick cover impedes foot traffic and examination of the ground. A final type of land cover in the region is spruce forest. The thick pine needle mat hinders surface visibility. Shade from trees also makes the surface harder to see and artifacts can remain obtrusive to the observers.

Characteristics of artifact assemblages themselves have impacts to survey results. Artifact characteristics of size, shape, and color combined with local conditions affect obtrusiveness and recovery probabilities. Obtrusiveness refers to the probability of artifact recovery taking into account the survey strategy (Wandsnider and Camilli 1992). Ceramic sherds dominate the artifact assemblage in Rough Cilicia. These sherds are predominately orange to red in color resembling the schist rock formations

located throughout the area. The ground surface is full of background confusion leading to misidentification of sherds that are really rocks, and vica versa.

A final condition to be considered when discussing surface survey data quality is the survey methodology itself. Surface survey is a systematic way to sample the distribution of artifacts on a landscape. The RCSP survey strategy involves surveyors walking transects usually about 10 to 15 m apart and recording the number of artifacts located within the transect. The landscape was divided up into survey units and subunits broken down according to land cover with natural boundaries. The analysis of this study is to determine the initial reliability of the survey strategy, which derived the systematic sample. Distance between surveyors, time spent surveying, proficiency of individual surveyors, and scales of artifact recording must all be considered.

## Methodology

Resurvey values are described in terms of sherd density per 10 square meters as a normalization method to compare between survey areas regardless their original size. To calculate the actual surveyed area with in a survey unit, the transect length total for all of the surveyors is multiplied by 1.5 meters. The 1.5 meter value is derived from the visual path a surveyor can ideally examine as they are walking a transect. The sherd density can then be calculated from the survey area and the total number of sherds observed by the surveyors.

The 1.5 meter estimate of the visual path observed by individual surveyors may be underestimated according to some. For example, Bintliff and Snodgrass (1988) use a 5 meter visual path estimate. It is assumed that the widths of visual paths, and therefore the actual area surveyed, are dependent upon visibility conditions, surveyor experience, sunlight conditions, time spend surveying, artifact obtrusiveness, and so on. Therefore, in this analysis preferred to remain conservative with the visual path estimate.

Density is a widely used quantitative measure for analysis in archaeology, seen as a reflection of patterns in past human behavior. Although criticisms of density as a measure of past adaptations can be addressed (see Byrd and Owens 1997 for discussion), this analysis is not focused on interpretation of the archaeological record. Rather, density is used as the best measurement to analyze data quality and reliability issues.

## Results

Table 1 reports the artifact density results reported for the 12 survey units selected for resurvey. In 2000, surveyors walked approximately identical transects relocated from 1998 survey unit recording forms and sketch maps. Visibility did not appear to change over the years. Surveyors were even matched up to original transects that would have been initially recorded by someone with a similar artifact identification proficiency level. Although surveyors were aware of the conditions of the resurvey, they were not told the number of sherds recorded in 1998 so that the resurvey would not become a competition to see which field crew identified the most artifacts. Essentially the same conditions were recreated.

Despite this, discrepancies existed between the two survey episodes and reliability was an issue. Interestingly in every instance except one, Survey Unit 8-3, the 2000 survey located more sherds than in 1998 (Table 1). A closer look at the density differences values reveal that most of the discrepancies are less than 5 sherds per 10 square meters, not a high value. A reliability correlation was calculated at $r(XX)= 0.63$ between 1998 and 2000 results (Table 4). According to the definition of $r(XX)$, this suggests that 37% of the variability of the two survey episodes is attributed to random error and 63% of the variability is due to true differences in the number of sherds encountered in the survey units. Generally, reliability coefficients

below 0.8 are considered unreliable (Nance 1987).

However, given the small density values in many of the survey units a more appropriate way of testing for reliability of the survey is to compare the results in terms of density rank, a categorical calculation of sherd counts. A rank variable was assigned to each category. The rank ranges from 1 to 9, with 1 representing the lowest density and 9 the highest (See Table 2). It was based on other RCSP ceramic density analysis (Chung 1999).

Describing the results as a relative pattern in terms of density rank will allow the patterns of discrepancy to be better understood. We have moved from a quantitative descriptor of density to a qualitative descriptor of rank. Given the purpose of this study as commenting on the data quality of survey results, it is more appropriately described in a qualitative term because the actual number of sherds in the record is unknown.

Table 3 reports the difference in density rank between the two survey episodes. A few of the results did not change in rank, receiving a value of zero. A majority moved one or two rank intervals. These results are considered to reflect moderately reliable data. Again to more specifically test for reliability a correlation coefficient was calculated at r(XX)= 0.88 (Table 4). In terms of density rank, the survey results between 1998 and 2000 are considered reliable.

### Discussion

The reasons for possible variations between the results need to be examined. A percentage of the variation can be attributed to systematic error. It isn't expected that the results will be exactly the same all the time. However, these variations would be small.

A higher amount of variation can be attributed to introduced personal biases and personal surveyor performance, or lack thereof. Many factors affect personal bias, which can differ between surveyors and can even change in intensity throughout the day or within the survey unit. For the data collected in 1998, a more rigorous assessment of surveyor performance was calculated to determine accuracy of individual results (Chung 1999). Details of this assessment will not be presented here, but the study indicates that surveyors were highly variable within their results. It could be possible that the 2000 crew was not as variable in their personal performance, individually more reliable in results reported. To be reminded, in every instance but one, the 2000 crew located more sherds than the 1998. It is suspected that most of this variation is due to surveyor bias and/or performance. If formation processes, plow zone sampling, or some other factor independent of the surveyor were the primary reason of disparity, discrepancies both on the positive and negative side would be expected. The 2000 crew was also made aware of the special nature of the survey, possibly heightening recovery. This would explain the fact that 2000 results reported higher density values than the 1998 results.

Other variation may be attributed to plow zone sampling effects as previously described. Plow zone archaeological surveys in other areas have determined that current land modifications have affects on the surface assemblage (Ammerman 1985; Dunnell 1988; Fentress 2000; Odell and Cowen 1987). Each plowing episode churns up a new surface assemblage varying in density and artifact class and size representation. Results of controlled studies of plow zone assemblages indicate that for every one sherd observed on the surface there are between 14-20 circulating in the plow zone (Ammerman 1985), or about a 5 to 6 percentage recovery (Odell and Cowen 1987). If artifact density is high, the effects of plow zone sampling are expected to be small. However, if density is low the influence is much greater (Dunnell 1988).

Plowing also can also account for substantial down slope displacement of artifacts (Ammerman 1985). Although plowing is normally lateral to steep grades in the Rough Cilicia region, (unlike other areas in the Mediterranean where plowing is

regularly up and down slope (Ammerman 1985; Fentress 2000), downward displacement is still expected to be a factor due to the steepness of the area. Terrace construction within plowed contexts also increases the downward movement of material by cutting away the upper slope and covering the down slope (Fentress 2000).

Thus modern farming, as well as ancient, can smear and even eradicated artifact distributions. Resurvey data from other plow zone contexts and this study has suggested that single inspections of agricultural areas are not sufficient (Ammerman 1985; Dunnell 1988; Shott 1995). Similarly the RCSP data suggests this. When analyzing only the agricultural fields selected for resurvey (n=8), r(XX) = .60 in terms of artifact density. For nonagricultural fields r(XX) = .99 (Table 4). It appears that in terms of ceramic density results of survey units in agricultural fields are unreliable. Nonagricultural field received a r(XX) value above .8 and are therefore considered reliable.

Similarly as with the results for all survey units presented above, results calculated in terms of density rank are considered reliable. Rank refers to a categorical delineation of ceramic density. In these terms, r(XX) = .85 for agricultural fields. None of the nonagricultural fields changed in density rank after the resurvey. Regardless of the statistical reliability of the rank values, the message is clear. Areas under cultivation are variable in their survey results due to the unique plow zone conditions mentioned previously and possibly require resurvey to fully record this variability.

***Survey Strategy Implications***

The purpose of this analysis of resurvey results was not to determine that data results are true or false representations of the archaeological record. Rather, the purpose was to determine ways in which to develop the survey strategy of the RCSP to improve the reliability of the resulting archaeological document, which in turn reflects the reliability of archaeological interpretations.

One way to ensure that results will be accurate is to test the level of reliability of each individual surveyor. The RCSP field crew, like most archaeological fieldwork, is made of mostly students. Although students can often be a valuable asset, their lack of experience can impact the accuracy of data. Of course it is not expected that everyone will see every artifact all of the time, but surveyor performance assessments can correct for accuracy variation. Prior to fieldwork test survey areas with varying conditions can be seeded with a known amount of artifacts and then subsequently surveyed by the field crew. Results indicate the level of surveyor performance and sherd recovery rate. This can be done numerous times throughout the season and the reliability of the surveyor to get the relatively same result can be calculated and statistically interpolated into results. Alternatively, survey units can be seeded with modern ceramic tiles and surveyors record the number of actual artifacts and seeded artifacts.

Also, accuracy and reliability of data will be strengthened further through strict data collection procedures ensuring that everyone is on the same page, identifying sherds as sherds and rocks as rocks, etc. Also the paperwork, the record of survey results, should be finished completely and as accurately as possible. After survey of an area the data becomes our only version of the archaeological record. It never hurts to be reminded that the simple things can have a big impact on ultimate interpretations. We are trying to study the variation of the archaeological record, not the variation that the archeologists impose on the data. In addition, survey forms should include information not just on visibility and modern land use but taphonomic factors such as erosion patterns and geomorphology. Recording the depositional environment will provide information on how these factors affect artifact obtrusiveness.

Another improvement could be made to the actual collection method of data. As

mentioned previously, artifact density is the primary category of data analysis used in archaeological research. However, density does not take into account the size of the artifact. Five large sherds per 10 square meters does not mean the same as 5 smaller sherds found within the same area. Recording the size of sherds and deriving surface area represented in a survey unit is a more appropriate way to present distribution data. The new areas surveyed 2000 recorded the width, length, and thickness of sherds as well as the totals. This data can then be manipulated to determine how formation processes affect the record, durability of sherds, vessel size, minimum number of vessels represented, etc. A surface area of sherds provides more information than density calculations alone.

Ideally, the most accurate representation of the surface would involve examination of the entire surface, not just a sample. This strategy involves much more time and people power than many projects can logistically afford. There are ways to improve sampling strategy so that dense and sparse artifact distributions will be observed. Surveying smaller parcels of land at closer transect intervals can potentially improve data quality. Smaller, closely placed transects will more accurately pick up the distribution of artifacts and will observe the small clusters possibly otherwise missed. In dealing with low-density surface features, a single inspection is not likely to encounter the event. Studies have shown that a transect interval of 15 meters will intercept 6-13% artifacts of a low-density population (Wandsnider and Camilli 1992:184). Concerning low-density areas, only some the artifacts in these areas will actually be observed (Cherry 1983). Artifact distribution is not a homogeneous distribution. Larger survey units suggest that it is. The RCSP research design places emphasis on the low-density areas as well as the high-density areas. Therefore, improving the methods of the systematic survey is essential to record the variable landscape.

As previously described, many of the survey areas are currently cultivated and plowing of the land acts as a sampling mechanism altering the assemblage visible on the surface. Unlike many areas of the world, agricultural practices in this region of Turkey have been untouched by modern mechanized invention. Wooden plows are used that have a much shallower tillage extent and fewer impacts. Therefore, because of the uniqueness of the Rough Cilicia region, an agricultural field was selected to determine how plowing episodes affect the surface assemblage and survey accuracy. In 2000, 90 ceramic tiles ranging in sizes were placed in a field and locations were mapped. In subsequent seasons this field will be revisited after plowing episodes and artifact densities and distribution recorded. Results will indicate how the current agricultural practices of the region are impacting the archeological record and the surface assemblage.

## Conclusions

Results of survey data collected in 1998 and again in 2000 (Tables 1, 2, and 4) indicate discrepancies between the two survey episodes. These discrepancies raise questions of the reliability of the RCSP survey results. Although the reliability coefficient for the density rank values indicated reliable data, issues of data quality come to light. Presented here just some of the variables that have an effect on the results of surface survey, including surface visibility, modern land modifications such as plowing, individual surveyor bias and performance, and characteristics of the surface artifact deposits. Many of the variables affecting data quality of surface survey are poorly understood and complicated further with variances among regional surface assemblage types, survey area conditions, sampling strategies, and research designs, etc.

Archaeological survey results must consider these factors affecting data quality to ensure accurate and reliable interpretations about the past. As for the

RCSP, several modifications to the survey strategy have been suggested to address these factors. These include individual surveyor performance assessments, improvement of data collection procedures including recording surface area of sherd in addition to density, surveying at closer intervals in smaller survey units, and a plow zone archaeological study specific to the Rough Cilicia conditions.

An accurate representation of the archaeological record must consider how these variables affect the reliability of survey results. Interpretations are only as reliable and accurate as the data from which they are based. Issues concerning data quality cannot be taken for granted and must be considered. Only archaeological data that is recorded accurately and reliably will be adequate to supplement our interpretations about the past.

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**Figure 1: Location of Rough Cilicia Archaeological Survey Project.**

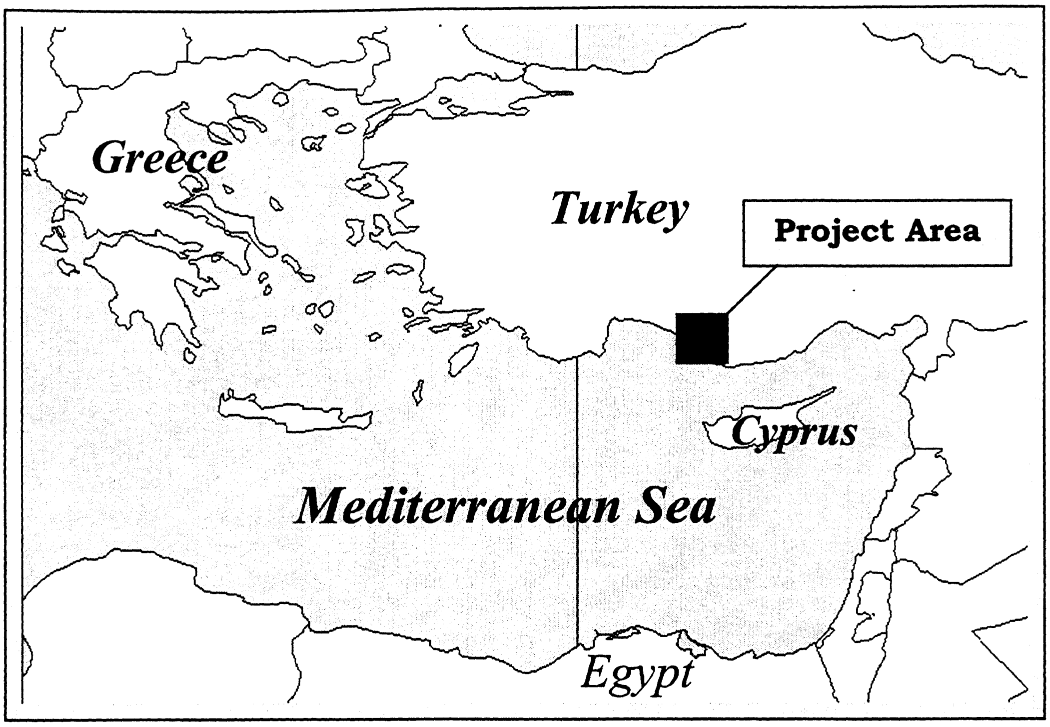


**Table 1: Ceramic sherd density results of surface survey from 1998 and 2000.**

| Survey Unit | 1998 Density per 10 sq. m | 2000 Density per 10 sq. m | Density Difference |
|---|---|---|---|
| **8-2** | **.00** | **.97** | **-.97** |
| **8-3** | **2.11** | **1.58** | **.53** |
| **8-4** | **1.74** | **4.87** | **-3.13** |
| **9-6** | **11.84** | **83.71** | **-71.87** |
| **10-1** | **11.05** | **13.54** | **-2.49** |
| **10-2** | **3.67** | **7.35** | **-3.68** |
| **13-1** | **35.60** | **42.46** | **-6.86** |
| **13-4** | **1.49** | **2.24** | **-.75** |
| **13-5** | **.47** | **3.77** | **-3.30** |
| **13-6** | **20.56** | **30.39** | **-9.83** |
| **13-7** | **.58** | **2.31** | **-1.73** |
| **13-8** | **.94** | **2.82** | **-1.88** |

**Table 2: Ceramic sherd density divided into density rank values.**

| Ran k | Density Range (per 10 sq m) |
|---|---|
| 1 | <.50 |
| 2 | .51 - 1.00 |
| 3 | 1.01 - 1.50 |
| 4 | 1.51 - 2.00 |
| 5 | 2.01 - 2.50 |
| 6 | 2.51 - 4.00 |
| 7 | 4.01 - 7.00 |
| 8 | 7.01 - 20.00 |
| 9 | >20.00 |

**Table 3: Ceramic sherd density rank results of surface survey from 1998 and 2000.**

| Transect | 1998 Density Rank | 2000 Density Rank | Density Rank Difference |
|---|---|---|---|
| 8-2 | 1 | 2 | 1 |
| 8-3 | 5 | 4 | 1 |
| 8-4 | 4 | 7 | 3 |
| 9-6 | 8 | 9 | 1 |
| 10-1 | 8 | 8 | 0 |
| 10-2 | 6 | 8 | 2 |
| 13-1 | 9 | 9 | 0 |
| 13-4 | 3 | 5 | 2 |
| 13-5 | 1 | 6 | 5 |
| 13-6 | 9 | 9 | 0 |
| 13-7 | 1 | 5 | 4 |
| 13-8 | 2 | 5 | 3 |

**Table 4: 1998 survey and 2000 resurvey reliability results.**

| | Reliability r(XX) | |
|---|---|---|
| | Density per 10 sq. m | Density Rank |
| All Survey Units | .62 | .88 |
| Agricultural Units | .60 | .85 |
| Nonagricultural Units | .99 | 1.0 |

** In general reliability coefficients below .8 are considered unreliable (Nance 1987).