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SITE-BASED AND NONSITE ARCHAEOLOGICAL SURVEY:

A COMPARISON OF TWO SURVEY METHODS

IN THE CITY OF ROCKS, IDAHO

by

Patrick Reed McDonald

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Anthropology

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UTAH STATE UNIVERSITY
Logan, Utah

2015

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ABSTRACT

Site-based and Nonsite Archaeological Survey: A Comparison of
Two Survey Methods in the City of Rocks, Idaho

by

Patrick Reed McDonald, Master of Arts

Utah State University,

2015

Major Professor: Dr. Steven R. Simms
Department: Sociology, Social Work, and Anthropology

Pedestrian based archaeological survey is commonly used throughout the western United States to locate, identify, record, and interpret archaeological sites. While procedures, such as transect spacing, transect orientation, data collection, artifact documentation, and site criteria may vary, most survey methods share a common goal: to locate and define the boundaries of archaeological sites. Other researchers question the traditional site-based survey method. Critics suggest that site-based surveys may fail to adequately detect and document artifacts outside of site boundaries (Dunnell and Dancey 1983; Wandsnider and Camilli 1992). Site-based methods may not discern archaeological signatures of past cultures that occurred on the scale of landscapes rather than discrete sites (Ebert 1992; Robins 1998)

In response, siteless approaches have been developed to test and address perceived shortcomings of site-based survey methods. The siteless survey utilizes

artifacts as the basis for studying the relationships between clustered and non-clustered materials.

This thesis examines traditional site-based survey vs. siteless survey within a study area in southern Idaho. Moreover, the study investigates the utility of the nonsite approach to identify spatial distributions, associations, and patterning in cultural materials on the surface of the analysis area. The results of the survey, data management and analyses evaluate if artifacts are randomly distributed or aggregated.

Survey results compare the surveys' effectiveness in detecting artifacts. In this comparison, the effects of artifact obtrusiveness/visibility are considered. Results of survey data are examined at different spatial scales to identify clusters and evaluate cluster attributes. Spatial patterning analyses use GIS software including the Getis Ord G_i^* hot spot analysis tool and the buffer tool in ArcMap 10.2. Both GIS analyses successfully identified clustering.

Finally, the results of analysis compare artifact cluster attributes identified by GIS analyses with site attributes. Siteless survey data and post-field, GIS analyses demonstrate the ability to offer information not available through traditional site-based survey. These results suggest that the siteless survey methods and analytic techniques employed in this study warrant further testing and evaluation.

(117 pages)

PUBLIC ABSTRACT

Site-Based and Nonsite Archaeological Survey: A Comparison of Two Survey Methods in the City of Rocks, Idaho

Patrick Reed McDonald

Archaeology in the western United States frequently employs pedestrian survey of the ground surface to locate and identify archaeological sites. Proponents of alternative survey techniques suggest that site-based survey may be inherently flawed and will not accurately detect, document, or account for artifacts located outside of site boundaries. Site-based survey identifies artifacts, and then searches the area more intensively in an attempt to identify a spatial break in artifact presence. Nonsite approaches utilize point plotting of all discovered artifacts in order to quantitatively identify relationships between artifacts. Quantitative analysis removes a level of researcher bias from the interpretation of past behavior. A comparative study utilizing both approaches in southern Idaho provides data to assess the effectiveness of each method to identify spatial distributions, associations, and patterning among archaeological materials.

This project was partially funded through the National Park Service (NPS), City of Rocks National Reserve, Idaho and implemented by the NPS, Utah State University Archaeological Services, and the Utah State University Department of Anthropology.

Nonsite survey met predicted expectations by identifying 28 percent more artifacts than site-based survey. Nonsite survey located a higher number and diversity of formal tools, potentially indicative of a wider range of cultural activities. Importantly, post-field analyses of the nonsite survey data utilized two tools in ArcMap GIS software to identify artifact clustering at varying spatial scales. These clusters were not identified

by the site-based approach. Enhancing our understanding of artifact patterning and spatial associations using a nonsite approach may better inform us of past behavior at a landscape or regional level, rather than specific sites. However, significant differences in coincident artifact detection demonstrate that archaeological survey methods are a sample of the archaeological record, and no survey can be expected to locate all artifacts or features.

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Reed McDonald

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CHAPTER 1

INTRODUCTION

Pedestrian based archaeological survey is commonly used throughout the western United States to locate, identify, record, and interpret archaeological sites. While procedures, such as transect spacing, transect orientation, data collection, artifact documentation, and site criteria may vary, most survey methods share a common goal: to locate and define the boundaries of archaeological sites.

Several researchers question the traditional site-based survey method. Site-based methods may not discern general archaeological signatures of past human behaviors that occurred on the scale of landscapes rather than specific sites (Ebert 1992; Robins 1998). Critics suggest that site-based surveys may fail to detect, document, or account for artifacts located outside of site boundaries (Dunnell and Dancey 1983; Wandsnider and Camilli 1992). Intersite areas may contain low density, non-clustered artifacts, or be void of surface artifacts. In these cases, subsequent analyses may not adequately identify spatial patterning at large scales (Burger et al. 2004; Dunnell and Dancey 1983; Ebert 1992; Robins 1998).

Potential shortcomings of traditional site-based survey resulted in the development of alternative survey approaches. These alternatives are termed landscape archaeology (Kvamme 2003), siteless archaeology (Dunnell and Dancey 1983), distributional archaeology (Ebert 1992; Wandsnider and Camilli 1992), and nonsite archaeology (Robins 1998). This study proposes to evaluate the siteless survey method that arises from the perspective of landscape archaeology and its collective forms.

This study examines the use of traditional site-based survey vs. a siteless survey within the same area to investigate the utility of the nonsite approach. The study area, located in southern Idaho, is referred to as the Tracy Lane analysis area. The site-based survey method utilizes 15 m transect interval spacing, with the ability to decrease survey spacing and increase search intensity upon artifact encounter. Additionally, site-based survey has complete freedom to examine previously surveyed areas near the discovery location in order to identify site boundaries.

The siteless survey method employs 5 m transect spacing and documents the spatial location of each artifact to a 5 x 5 m cell within a pre-established grid. Upon artifact encounter, the siteless approach codes the cell as positive. The siteless survey is required to maintain constant 5 m spacing and previously surveyed, or unsurveyed areas are not available for a more intensive search. This study will examine the two methods' abilities to:

- (1) Detect both clustered and non-clustered materials
- (2) Identify and recognize spatial patterning in surface artifacts located by each survey.

Siteless survey methods differ from the traditional site-based survey in several aspects. The primary objective of siteless approaches is not to locate and define the boundaries of archaeological sites. It is to examine the spatial distributions and associations of all artifacts detected and documented in the entire surveyed area. Siteless survey has the potential to provide more robust spatial analyses (Wandsnider and Camilli

1992). This process can be accomplished by using more tightly spaced survey transects to locate and document artifacts and archaeological features and by deferring spatial clustering analyses until after completion of field work. Siteless survey and related applications have been theoretically constructed (Dunnell and Dancey 1983) and applied in different stages throughout the western United States (Burger et al. 2004, Ebert 1992, Kvamme 2003, Wandsnider and Camilli 1992, Thomas 1973) and the world (Ammerman 1985, Dunnell and Simek 1995, Isaac et al. 1981, Foley 1981, Nance 1980, Odell and Cowan 1987, Riordan 1988). However, only Burger et al. (2004) attempted to resurvey certain areas to compare results. However, Burger's study utilized narrow walking transects, crawling transects at shoulder width, and finally, limited excavation. This project adds to the depth of understanding the effects of transect spacing on artifact detection. The initial survey was conducted at a standard spacing utilized to identify archaeological sites, while the second method utilized transect spacing aimed at identifying artifacts based on non-site survey approaches.

The study area (also referred to as the analysis area) is near the boundary of the Great Basin and Snake River Plain within the City of Rocks National Reserve (CIRO) in southern Idaho (Figure 1). Vegetation is sparse, there is good surface visibility and there are no obstructing landforms. This study employs contrasting survey methods to examine two research domains.

The first research domain considers the detection of archaeological materials by each survey method. Transect spacing and its effects on artifact/site detection are important when examining the differences between survey methods. Ebert's (1992) work suggests that an archaeologist is only able to view between 1-2 m of the ground surface

while transecting under ideal study conditions. Such findings mean a survey using 30 m transect spacing does not observe the surface for 26 m between surveyors (or 93 percent of the surveyed area). When transect spacing is reduced to 15 m intervals, approximately 86 percent of the ground surface is unobserved. With 5 m transect intervals, 60 percent of the surface remains unobserved.

Building on Ebert's (1992) estimates, this study investigates the results in detection using 15 m transect spacing in a site-based approach and detection using 5 m transect spacing in a siteless approach. If Ebert's hypothesis is correct, then this study expects to see 26 percent higher artifact detection in the siteless survey method than in the site-based method. Investigation of this question uses simple measures of artifact density, and artifact types detected by both survey methods. Surveyor bias is reduced by using different crew members for each survey.

The second research domain deals with the ability of both methods to identify the spatial distribution, associations and patterning in surface archaeological materials from the surveyed area. Traditional site-based approaches enter the field with a priori criteria to define the spatial limits of sites. Nonsite approaches utilize spatial analytic methods based at the artifact level. Analysis of archaeological trends begins after the completion of field survey.

The second research domain examines Carr's (1984: 106-108) fundamental goals of archaeological analysis pertaining to spatial patterning. Carr frames these goals in the following research questions:

1. Are artifacts of recognized functional types randomly distributed over space or aggregated into clusters? If so, what are the spatial limits of those clusters?

2. Do artifacts of dissimilar types cluster together? And if so, what are the spatial limits of those multitype clusters?

These two questions provide the contest for comparison between siteless and traditional site-based surveys in the CRNR study area. Whereas search methods and spatial documentation differ between the two methods, documentation of artifact types and artifact attributes *are* similarly recorded. Investigation and comparison of spatial patterning, as revealed by the two methods, will utilize artifact attribute data. These data include artifact function, lithic material/color, artifact density, and indices (combining two or more attributes) to examine the two questions quantitatively.

Ebert (1992:188) points out an important consideration, that “clustering” is definitional: “its recognition and existence depend on the package one samples in.” If sites are represented by the cluster, then the scale of the clusters examined needs to be equal to or smaller than sites. In his nonsite survey of the Seedskaadee area in Wyoming, Ebert considers spatial patterning at varying geographic-spatial scales using a variety of measures.

Ebert’s (1992) spatial analyses at varying scales provide a useful platform from which to examine spatial patterning in the CRNR study area. This study will use Getis Ord G_i^* to determine if statistically significant clustering exists in artifact distributions documented by each survey method. The Getis Ord G_i^* tool also identifies where clustering overlaps or diverges in each of the two field methods. Geospatial Hot-Spot Analysis (Getis-Ord G_i^*) provides spatial statistics to identify statistically significant

spatial clusters (hot spots with high values and/or cold spots with small values) represented by z-scores and p-values (ESRI 2015b).

A high Z score and small p-value (probability) for a feature indicates a spatial clustering of high values. A low negative Z score and small p-value indicates a spatial clustering of low values. The higher (or lower) the Z score, the more intense the clustering. A Z score near zero indicates no apparent spatial clustering (ESRI 2015b).

Equally important to the comparison of site-based and siteless survey methods is an examination of data located outside of site boundaries (as defined by the traditional site-based survey). As noted by Dancey (1971, 1973, 1974, 1976) and others (e.g., Wilke and Thompson 1977), understanding regional landscape use demands documentation of intersite space. While this study does not attempt to correlate survey data to larger land use patterns, it does take into account intersite space containing low artifact density or negative results in the comparison of the two survey methods.

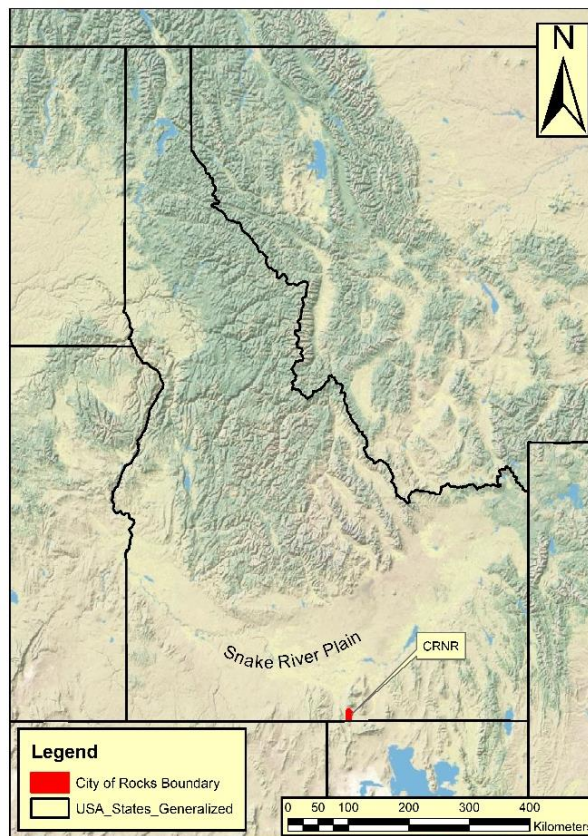


Figure 1. Location of the City of Rocks National Reserve (and the Tracy Lane Analysis Area) in Idaho.

This study proceeds from the premise that, “*the surface archaeological record constitutes an appropriate source of data upon which to conduct archaeological research*” (Dunnell and Dancey 1983:270; emphasis in original). The study is restricted to a critical evaluation of two different pedestrian survey methods and their ability to detect and recognize archaeological materials and elements of their spatial patterning. Consequently, this study can serve as a useful assessment of a traditional site-based approach and a nonsite approach applicable to the archaeological record of southern Idaho.

CHAPTER II

THEORETICAL FRAMEWORK AND EXPECTATIONS

Site-based archaeological survey methods are typical for most archaeological surveys. Archaeologists walk transects at specified distances apart. Upon artifact encounter, an attempt to define site boundaries is made and this guides site recording. Regional, agency, project, or individual researcher preference influences the definition of a site. Variation in site definitions leads to a wide range of site determinations and interpretations.

In contrast, the siteless, or landscape approach argues that delineating sites and limiting study to within sites hinders our ability to interpret past human behavior because modern site boundaries do not necessarily correspond to past activities. The siteless survey utilizes artifacts as the basis for identifying clustered and non-clustered materials and their spatial relationships. Additionally, siteless survey eliminates boundaries applied to artifact clusters perceived as activity areas. Subsequent analysis may identify patterns based on both quantitative and qualitative measures. Furthermore, these analyses may reveal patterns that were previously unidentified during the course of field survey.

This chapter describes the theoretical and methodological constructs underlying the siteless or landscape approach:

- (1) The cultural processes leading to artifact discard (primary deposition).
- (2) Cultural and natural factors affecting artifact location (secondary deposition).
- (3) The use of sampling in archaeological survey.

- (4) Issues associated with site-based survey.
- (5) Siteless survey's approaches to recognizing spatial patterning in the surface archaeological record.

Natural and Cultural Process and the Surface Archaeological Record

Ebert and Kohler (1988:123) note that “the complex patterning of cultural materials across space is the result of human mobility, the spatial patterning of different economic activities, the redundancy in economic activities across the landscape and the differences in the locus of artifact discard versus that of use.” These materials and their associational patterning undergo further changes before discovery by the archaeologist. Cultural processes cause some of these changes, such as reuse of a site, reclamation of objects, and remodeling. Additionally, many natural site formation processes related to geomorphic processes such as erosion and various forms of deposition alter artifact location (Ebert and Kohler 1988:123). A discussion of the relationship between site formation processes, the spatial patterning of archaeological materials, and ethnographic and ethnoarchaeological documentation of hunter-gatherers informs this project and the comparison of two approaches to archaeological survey.

This study area is in an area ethnographically occupied by prehistoric hunter-gatherers. In such contexts, the archaeological record is shaped especially by subsistence and settlement patterns. A significant synthesis by Binford (1980) characterized landscape use and resource procurement activities taking place in three areas or zones on the landscape. These zones are the residential base, foraging radius, and logistical radius.

The residential base is documented ethnographically in all human populations (Ebert 1992:29). It is where daily activities take place, leaving the remnants of activities such as child-rearing, cooking, and tool maintenance (Binford 1980). The foraging radius extends from the residential base and includes activities associated with the exploitation of local resources. The length of stay within the foraging radius usually does not extend more than a day. The logistical radius extends beyond the foraging radius and reflects the transport of resources to the residential base, often by specialized groups. The length of time within the logistical radius usually lasts at least one night, but can be much longer (Ebert 1992). While the exploitation of some resource patches occurs on an annual basis, residential bases and camps tend to move, except in the case of topographic constraints, such as rockshelters (Ebert 1992), or topographically confined terrain. The resulting archaeological sites are thus often the product of repeated occupations that are not direct overlays. This patterning creates large archaeological assemblages scattered or smeared across places utilized in spatially differentiated ways.

Binford (1980) also identified two structurally distinct means of landscape use: foragers and collectors. Foragers “map on” to their environment, moving into the foraging radius and returning to relatively short term camps. Camp locations move frequently, tools tend to be expedient, and storage is not usually a central feature of such systems. In contrast, the collector pattern is logistically organized. Central bases anchor a suite of short term camps from which resources are transported, “logistically” to the residential base (Binford 1980). Toolkits of these groups tend to be more specialized and may feature curated technologies using exotic materials (Kelly 2007). Associated with

these logistical forays, archaeologists might expect to see curated goods, fewer expedient tools, and reduced variability in tool form and material types.

These patterns hold implications for the spatial structure of the archaeological record, and the aim of this study to compare site and siteless surveys to describe that record (Butler 1968, Plew 2008, Simms 2008:32-37, Thomas 1973, 1974). The collector pattern is more likely to result in initial discard near residential bases that archaeologists view as artifact clustering. Many activities associated with collectors, and as foragers, are likely to create a low density archaeological pattern comprised of dispersed artifact scatters and clusters. This overlap represents thousands of years of land use.

Residentially mobile foragers are unlikely to reoccupy a residential base and instead create new residential areas, or ones that are at least spatially off-set. At the same time, groups continue to exploit the same foraging radius through time, but again create short-term camps and activity locations that may not be symmetrical with previous occupations. Thus, the spatial patterning observed by archaeologists is one of overlap and palimpsest assemblages rather than discrete archaeological events. Binford's model is a multidimensional rather than an absolute statement, or even a continuum (Chatters 1987). Many mobility patterns are the result of a blending of residential mobility strategies. While other factors can influence the arrangement of archaeological materials, as previously mentioned, the assumed characteristics are less likely to be a result of both short-term and long-term temporal overlap.

Both Foley (1981) and Gould (1980) suggest that indigenous populations discard very low numbers of artifacts within the residential base. Indeed, in the absence of architectural remains, residential bases may be difficult to identify on the basis of

artifacts alone. Most artifact discard occurs within the “secondary home range foci” (Ebert and Kohler 1988:113). This pattern results in an even, low-density discard across the landscape. Over long periods, the discard process can produce “relatively continuous densities of discarded materials” (Ebert and Kohler 1988:113).

Post depositional processes commence immediately and include both cultural and natural processes (Binford 1979, Ebert 1992, Wandsnider and Camilli 1992). Once artifact discard occurs, it may remain on the surface for a long time, or be buried immediately. Both cultural and natural processes may move surface artifacts from their original location (Ebert 1992:40). These processes include aeolian, colluvial, fluvial, or lacustrine deposition. Additional movement may occur as a result of erosion, freeze-thaw movement, bioturbation or faunal turbation (Baker 1978, Foley 1981, Rowlett and Robins 1982).

Using the Surface Archaeological Record for Analysis

Surface cultural material poses distinct problems of analysis in comparison to stratified deposits where at least some of the spatial relations can be constrained by stratum, soil horizons, paleosols and such. Surface artifact assemblages are frequently discounted due to the lack of temporal control as noted by Ebert (1992:11). The perceived need to separate artifacts into their appropriate time frames discounts their role within a complex archaeological system that spans great periods of time.

It is often difficult or impossible to account for all of the potential factors that result in the artifact location. Quite frequently, the primary value of surface materials is

limited to identifying locations that may contain buried cultural material. Indeed, the possibility of buried cultural remains tends to be the primary criteria for the ascription of National Register significance under Criterion D.

Others counter that the surface archaeological record contains scientific value (Dunnell and Dancey 1983) precisely because the surface archaeological record is “likely the product of extensive reuse and recycling by many individuals, possibly from many groups or cultures” (Ebert 1992:10). Artifacts and their locations, including those found on the surface, are the result of “mobility, procurement of materials, and the use of landscapes by human systems” (Ebert 1992:10-11) and thus contain interpretational value.

The surface archaeological record poses complications such as cultural and natural formation processes and their effects on artifact movement. However, in light of the high cost of archaeological excavation, it is appropriate that surface archaeology continue for its analytical potential. Despite the alterations of post-depositional processes, ample evidence exists that the spatial context of surface archaeology can yield information useful to scientific study (Ammerman 1985, Dunnell and Simek 1995, Odell and Cowan 1987, Riordan 1988).

Archaeological Survey as Statistical Sampling

Archaeologists utilize sampling to obtain information about sites, project areas and regions (Ammerman 1985, Dunnell and Simek 1995, Ebert 1992, Ebert and Kohler 1988, Foley 1981, Riordan 1988, Thomas 1973). Archaeological survey sampling

techniques include random samples, stratified sampling, “intensive” survey, and intuitive based survey. Sampling studies attempt to obtain information about a larger area where data is lacking. In these cases, sampling can be used to develop expectations for areas not yet subject to survey. The “intensive” survey is designed to provide complete coverage of an area, yet even intensive surveys can yield considerable variation in sampling and coverage.

There may also be differences in what researchers perceive to be a complete or intensive survey. Wandsnider and Camilli (1992) and Ebert (1992) suggest that five m survey intervals locate only 20 percent of dispersed items and 80 percent of clustered items. Wandsnider and Camilli (1992) further suggest that surveyors cannot view the ground surface more than 1-2 m on either side of their transect line. This means that archaeologists only observe 14 percent of the ground surface when using 15 m transect intervals. At 5 m intervals, 40 percent of the ground surface is considered surveyed. When studying landscapes at the level of the artifact, we can assume that we are only identifying a sample of the total population of artifacts that exist on the landscape. Archaeologists will usually never know the actual population of surface artifacts on the landscape.

In one of the more “intensive” survey approaches, Burger et al. (2004) utilized a Modified-Whittaker multiscale sampling plot and a nested-intensity survey approach. Rather than delineate site boundaries, Burger point-plotted individual artifacts and then compared rates of recovery for different survey methods. This approach utilized a 70 cm interval pedestrian survey to record artifacts, and then a crawling survey across a portion of the walking survey, and finally excavation to 10 cm of some subplots. Walking 70 cm

transects located 78 percent fewer items than the crawling survey identified. Even these narrow transect widths recovered only a fraction of the actual surface archaeological record, and it can logically be expected that increasing transect width would only decrease the percentage of artifacts discovered.

The practice of defining bounded sites further complicates the sampling results. A substantial portion of pedestrian based surveys aims to use the surface archaeological record to identify bounded sites by defining baseline criteria such as artifact density over a defined space (e.g., one item/five m²). Recordation may not occur for artifacts that don't meet the baseline site criteria. When documentation misses a potentially large portion of the actual population, the surface record may not be used to its full potential.

This study utilizes a site-based approach with transects spaced at 15 m intervals and a siteless survey approach utilizing 25 m² grid cells to examine spatial patterning at clustered and dispersed surface materials within the same area. The measures provide two samples of the surface archaeological record which can be used to compare results and to study spatial patterning. This project allows for critical evaluation of archaeological survey methods that have been structured from Squier and Davis' (1848) work and are still widely used today.

Site-Based Approaches to Archaeological Survey

One of the earliest archaeological surveys in the United States was conducted in 1848 (Squier and Davis). Squier and Davis' survey in the Eastern United States focused in the location and documentation of mound sites. By the end of the nineteenth century,

survey was being utilized as a means of locating sites for archaeological excavation (King 1978). Archaeologists place substantial effort on survey methods; most were designed to locate specific types of sites. Consequently, when cultural material was not located, or not studied, it was of little consequence to the researcher (King 1978). Subsequent studies attempted to locate and identify types of artifacts in order to create a reconstruction of cultural history (Willey and Sabloff 1974). During the 1930s under the Roosevelt administration, archaeology experienced a substantial increase in growth. Archaeologists were responsible for large, and untrained field crews. This created the need to standardize the definition of archaeological sites. These definitions have remained somewhat static, and shape site determinations today (King 1978).

A site is the smallest unit of space dealt with by the archaeologist and the most difficult to define. Its physical limits, which may vary from a few square yards to as many square miles, are often impossible to fix. About the only requirement ordinarily demanded of the site is that it be fairly continuously covered by remains of former occupation. The general idea is that these pertain to a single unit of settlement, which may be anything from a small camp to a large city. It is in effect the minimum operational unit of geographical space (Willey and Phillips 1958:18).

Clustered cultural material thus became a basic unit of classification, with the underlying theoretical assumption that the site reflects human behavior (Renfrew and Bahn 2004). The site concept continues to play a central role in archaeological interpretation. Black and Jolly (2003:9) state that an archaeological site is a place "on the landscape associated with some significant event or person or contain information important to history or prehistory. Sites can be natural features...cultural features... [or] a place where important ceremonies took place." The site is considered the basic unit of observation throughout the history of cultural resource management. The site is also the

critical unit of analysis in both procedural and legal terms for a determination of National Register significance.

Site-based archaeological survey focuses on identifying and categorizing archaeological materials into bounded entities; documentation then concentrates on describing and analyzing artifact assemblages from these bounded areas (King 1978). This process reinforces the perception that the cultural activity that created these entities are similarly bounded.

The discussion here indicates that substantial research on site formation processes and critical evaluation of the implications of site-based archaeology suggests this may not be the case. Rather, site-based archaeology holds biases as does any sampling and analytical approach. For instance, site-based archaeology may better reflect sedentary populations more than residentially mobile groups (King 1978).

Various entities charged with recording the archaeological record establish the criteria for defining a site. The Southwest Archaeology Research Group (SARG) defines a site as, “the locus of artifacts, features, or facilities with an artifact density of at least five per square meter” (Ebert 1992: 48). Schiffer et al. (1978:14) suggests decisions about site determinations must be made by crews with considerable expertise “to account for their decisions quantitatively.” These decisions allow for individual researcher preference and likely increase variability in site designations.

SARG’s interpretation is likely too high to identify activities that are the result of Binford’s (1980) forager patterns. The factors that control the kind, type, and density of artifacts can affect the materials that are recorded and accounted for in the field. These

factors, plus site size (i.e., small sites are less likely to be identified by wide transects) may be driving sampling techniques and field methods.

Pettigrew and Lebow's (1989) inventory in southeast Oregon defined sites as ten items with an area smaller than 100 m² or rockshelters with less than ten cultural items. Another project determined isolated finds to consist of ten or fewer artifacts in a single category, and anything more complex was considered a site (King et al. 1991).

Various criteria employed by regulatory agencies can pose challenges for individual projects involving multiple states. Jackson et al (1990) provides the following discussion for a natural gas pipeline project in Washington, Idaho, California and Oregon:

The criteria for defining a cultural resource location as a "site" differ among SHPOs in the various states along the pipeline route. The Oregon OHP [Office of Historic Preservation] does not recognize as [an] archaeological site any cultural resource locality with less than 10 observed pieces of debitage, and consequently the SHPO does not assign Smithsonian (i.e. permanent) site numbers to such resources. The policy of California OHP designates as sites those cultural-resource locations with three or more pieces of debitage. In documenting sites in the field we have followed the California procedure, and all such sites have been assigned temporary site numbers; however, only those cultural resources recognized as "sites" by the appropriate SHPO are referenced in this report by a permanent site designation. This is not an issue for any sites recorded in Idaho. The Washington SHPO assigns "permanent" site designations only to prehistoric archaeological sites and those historic (Euroamerican) cultural resources considered eligible for the NRHP [National Register of Historic Places] (Moratto et al. 1990:4.11).

While the pipeline project accommodated differing definitions of sites in their documentation procedures, definitional variations can affect interpretation and limits comparison of findings and hinders the interpretive ability of surveys and subsequent research using surface materials.

Many states vary their definition of a site-based on regional archaeological site trends (Idaho State Preservation Office and Archaeological Survey of Idaho 2012, Kansas State Historical Preservation Office 2012, State of Utah Office of Legislative Auditor General 2006). For instance, the U.S. Department of Interior-Nevada Bureau of Land Management defines a site as “any location containing two or more artifacts or features that are spaced no more than 30 meters apart.” Cultural material falling below this threshold are placed in another bounded classification – isolated finds; a sort of non-site site. Nevada’s BLM isolated find criteria states that an isolated find is, “a single artifact that is spatially discrete from any other artifacts by a minimum distance of 30 meters; a single artifact broken into two or more pieces (e.g., broken historic-aged bottle or broken prehistoric ceramic vessel) may be recorded as an isolated artifact as long as no other artifacts or features are associated within 30 meters of the artifact” (BLM 2012).

While the interpretation and definition of sites are relatively diverse, the identification of artifacts between sites, or the isolated occurrences is more uniform. However, isolated finds are often discounted entirely and excluded from further analysis. Schiffer and Wells (1982:376) suggest recording all archaeological occurrences to allow future researchers to use the same data to define a different set of sites (Schiffer and Wells 1982). Ebert (1992:49) “wonders why the methodological concept of the site is even necessary if this is the case.”

Due to the wide range of site identification criteria and knowledge of the shortcomings of the site concept, this project employed strictly defined site criteria. This criteria allows for explicit testing of the site concept and to compare it to a siteless approach. The criteria for this study are designed to interpret and bound low-density

artifact assemblages. This project's site definition is within the range of other site determinations (BLM 2012).

Siteless Approaches to Archaeological Survey

Landscape archaeology or siteless survey (also called distributional archaeology, regional archaeology, and surface archaeology) developed as an alternative survey method to traditional, site-based survey approaches. The siteless survey method borrowed from the theoretical and methodological approaches to biological studies of plant and avian populations to attempt to understand the distributional nature of past cultural systems.

Early landscape-based studies attempt to account for the number and type of cultural materials missed during site-based survey. Advocates of the siteless approach asserted that these methods provided for a more accurate understanding of the surface archaeological record and in turn provided enhanced abilities to model archaeological resources in unsurveyed areas (Heltshe and Ritchey 1984).

Early landscape approaches identified clustering on the landscape, which later developed into the identification of related artifacts (Dancey 1974, Davis 1975, Foley 1971, Goodyear 1975, Isaac et al. 1981, Jones 1984, Mason 1979, Nance 1980, Stafford 1985, Thomas 1972). These studies responded to problems studies that were incompatible with each other as a result of differential recording and survey procedures. For instance, archaeologists focused on identifying toolkits within environmental zones (Thomas 1973), activity areas, activity nodes, and cultural trends that existed on the entire landscape (Wandsnider 1996).

Landscape archaeology differs from site-based approaches by changing the minimum unit of observation/analysis from the site to the artifact. This concept was not entirely new. As early as 1953, Phillips and Willey challenged archaeological thought regarding this fundamental theoretical and methodological concept. These concepts had already shaped previous analyses and subsequent cultural interpretation. In 1958, the same authors argue that the definition of a site as a spatially bounded entity leads to spurious interpretations and does not account for environmental variability or post depositional processes. Following these ideas, other archaeologists (Ebert 1992, Foley 1980, 1981, Thomas 1973, 1974, Wandsnider and Camilli 1992) suggest that the site-based approach was subject to unintentional biases and errors, and had limited explanatory power to interpret past lifeway trends on a broad scale.

Proponents of the new approach argued that focusing data collection on clustered materials (sites) and excluding dispersed or non-clustered materials created incompatibility between data sets. They asserted that biases could be reduced or eliminated by reducing the minimum unit of classification to the artifact. Additionally, focusing analyses at a landscape level and using factors such as artifact size, material, tool type, distribution, environmental zone, etc. could further reduce biases influencing cultural interpretation. This methodological change allowed subsequent studies to discern archaeological patterns that site-based approaches did not recognize. These criticisms of site-based survey led to new archaeological approaches.

David Hurst Thomas (1972) was one of the first archaeologists to implement a non-site-based approach with his work in the Reese River Valley. Thomas study proceeded from theory to method. In this study he tested Steward's (1938) Great Basin

settlement pattern theory that suggested a seasonal round of the mobile Shoshonean groups in the Great Basin. While Thomas did not eliminate the site, his analysis instead focused on the interpretation of all artifacts and their location within a vegetation zone. Thomas believed that organizing the survey by ecozone would be useful to answer questions about past subsistence-settlement patterns (Thomas 1973).

Thomas (1972) randomly divided the study area into 500 x 500 m quadrats and mapped according to Steward's (1938) microenvironments. His hypothesis tested the differential use of resources within zones. Microenvironments consisted of the riverine environments, arid sagebrush flats, Pinion-juniper belt, and the upper sagebrush-grass zone (Thomas 1973:158). Thomas' study accurately predicted artifact relationships with greater than 80 percent success within the study area.

Nearly two decades later, Ebert (1992) conducted a study that utilized landscape archaeology in southwest Wyoming. Ebert focused on identifying the spatial patterning of the surface archaeological record using variance to mean ratios to examine the distribution of artifact types. This ratio allowed him to understand the degree of clustering at different spatial scales. He continued to use this approach and studied artifacts of varying material types and their association with specific landforms. Ebert used this information to infer the behavior of the cultural systems within different geographical areas (i.e., dunes, sagebrush steppe, valleys, and river terraces).

His study holds implications for how well survey discovers clustered and dispersed artifacts. Ebert's study also utilized intentional "seeding" of a study area with artifacts (metal washers) that were of varying size, and painted in colors that mimicked the local artifact assemblages. The subsequent survey discovered and mapped these

discoveries. Ebert's study found that surveyors located more than 60 percent of the intentionally seeded, clustered artifacts during the initial survey. In contrast, only 16 percent of dispersed artifacts were located (Wandsnider and Camilli 1992). Furthermore, Ebert identified the scale of patterning on the archaeological surface through the use of the variance to mean ratio. This mathematical calculation allowed Ebert to infer the levels of clustering at varying spatial scales. This finding results in the ability to compare peak levels of clustering or dispersal between datasets regardless of their physical location. These findings may in turn be used to infer patterns in behavior such as intensity of use, population size, and mobility.

Isaac (et al. 1981) utilized a landscape survey approach in Africa in a study of hominin populations two million or more years old. Their study found artifacts in alluvial contexts with a high potential for post depositional disturbance. Isaac sought to identify the effect of post depositional processes on the artifact assemblage. He employed a landscape approach to identify patterning in the archaeological record based on spatial analysis that was difficult to identify solely through survey. Thorough recording of artifacts' spatial location and orientation allowed him to identify artifacts that had been moved through post deposition processes. When archaeologists eliminated these artifacts from further analysis it allowed them to study only artifacts that resulted from cultural discard.

Foley (1980, 1981) also studied East African hominid populations in the lake basin of Amboseli in Kenya in what he termed "off-site" archaeology. His study attempted to identify potential human home range. Ecological calculations of resource productivity were generated to guide survey. Foley's study found that artifacts created in

what were once thought to be discrete sites are in fact, just subsamples of patterns on the landscape itself. He concluded that stratified sites are “extremely rare” (Foley 1980:39). Foley suggested “it may no longer be valid to use site distribution as a direct indicator of observed prehistoric settlement patterns” (Foley 1980:39). His study suggests that only one percent of artifacts created within the site are discarded within a site boundary.

These unique survey approaches suggest that artifacts located on the surface retain scientific value and the ability to interpret past behavior.

Recognition and Evaluation of Patterning in the Archaeological Surface Record

Siteless survey techniques share a common goal with site-based survey. Both strive to detect and examine clusters of archaeological materials representing human activities. However, siteless archaeology focuses on the artifact as the basic unit of analysis, while site-based archaeology identifies and organizes the analysis of artifacts at the level of the site. Siteless archaeology also attempts to account for dispersed artifacts between clusters. The potential underrepresentation of dispersed artifacts in site-based survey can mask archaeological patterning that may be important to understanding past human behavior.

Archaeologists recognize that surface survey focuses on identifying dynamic cultural behaviors through a static archaeological record (Binford 1980, Ebert 1992, Ebert and Kohler 1988, Wandsnider 1996). Ebert suggests that current archaeology underutilizes survey information in recognizing and evaluating spatial patterning. While all surface survey must contend with impediments such as artifact obtrusiveness, post-

depositional processes, palimpsest assemblages, crew experience, crew fatigue, lighting conditions etc., proponents of siteless survey suggest that site-based survey unintentionally introduces limitations. In-field delineation of site boundaries is based on perceived attributes. These attributes include density, artifact type, or landscape variability that wasn't necessarily a factor in primary deposition of the artifact (Dunnell and Dancey 1983, Ebert 1992, Foley 1981). In addition, site boundaries may constrain researchers' focus within arbitrarily placed research spheres and often do not account for dispersed materials.

CHAPTER III

FIELD METHODS

This chapter provides an introduction to the study and study area, a discussion of the study area environment, and a description of field survey and cultural material documentation procedures employed during site-based and siteless survey. The chapter includes methods for documenting spatial data and attributes of cultural material.

Introduction to the Study and Study Area

This study is based on a contracted archaeological survey. In 2012, the National Park Service contracted with Utah State University to conduct a site-based archaeological survey within the City of Rocks National Reserve (CRNR). The contract required completion of an intensive level, site-based survey of the three areas and associated site recording. Additionally, the contract provided an opportunity to conduct an additional survey on one of the three survey parcels to compare the results of a site-based survey and a siteless survey of the same area.

The purpose of this comparison is to evaluate site-based survey and siteless survey's ability to identify artifact clustering on the surface during pedestrian survey.

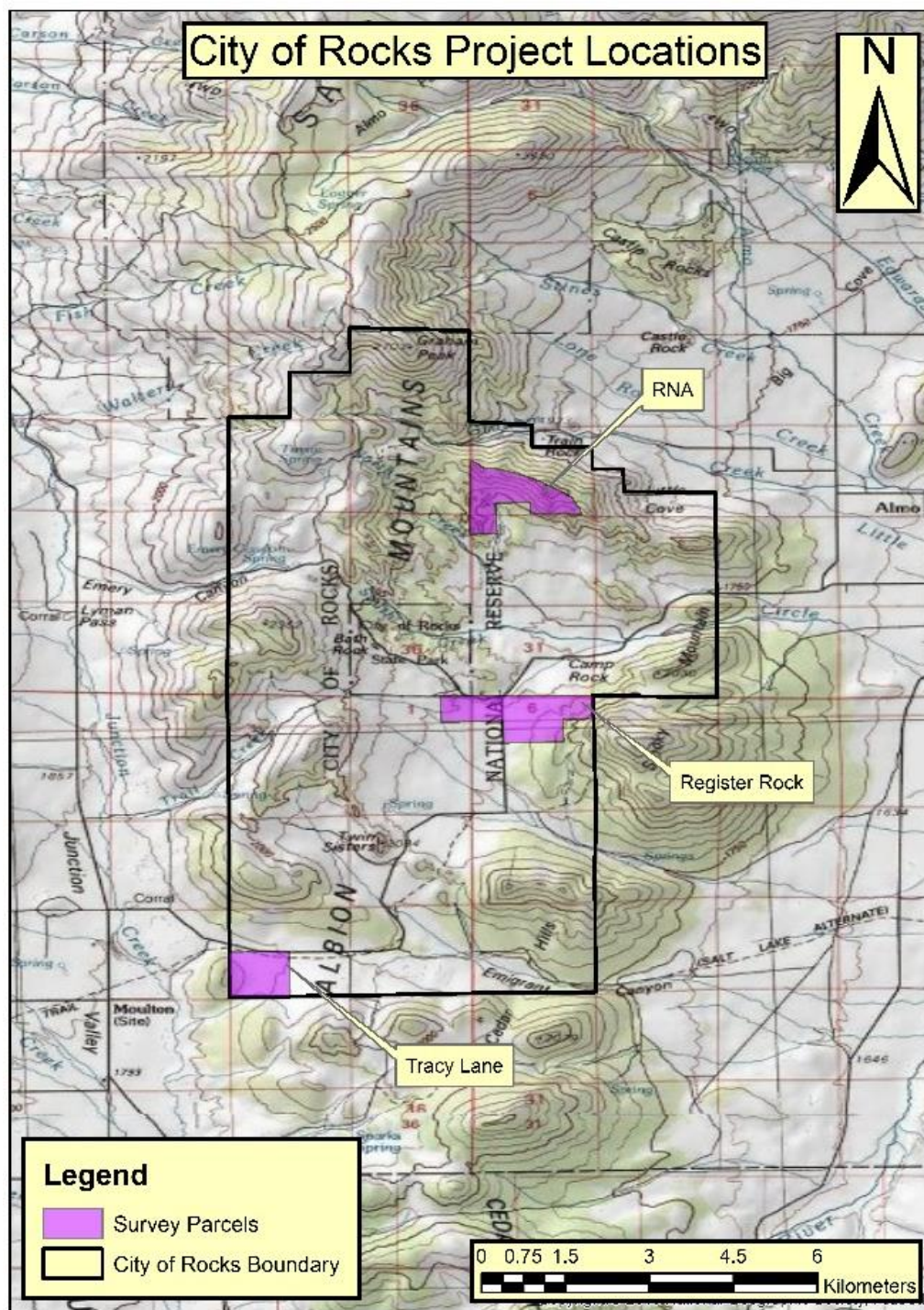


Figure 2. Topographic location of the three survey parcels within the area contracted for survey in the City of Rocks National Reserve.

The CRNR consists of approximately 106 km² (26,400 acres²) of land administered by the U.S. Department of Interior—National Park Service (NPS) in south-central Idaho. Through review of the CRNR’s General Management Plan by the NPS it became apparent that the CRNR was “lacking in the archaeological information required to assess the degree of impacts on cultural resources for various proposed actions” (National Park Service: 1996).

In some areas of the reserve, no archaeological survey had been conducted; notably, the Research Natural Area (RNA) was lacking survey data. Therefore, the NPS began to contract surveys. Contracting surveys allowed the area to increase their knowledge of the park as a whole and gain survey data for areas that had previously been unsurveyed. This also allows the NPS to better understand regional research themes (Shults et al. 2014:2).

Doctors Kenneth P. Cannon and Molly Boeka Cannon of Utah State University were the contract’s Principal Investigators. The author of this thesis served as the field director for the field survey, site documentation, and reporting for the contracted site-based survey and the comparative siteless survey.

Crew members were graduate and undergraduate students from Utah State University. Crew members ranged in experience, with all members having completed archaeological field schools and/or experience conducting field survey. All crew members were provided with pre-field training to familiarize themselves with the Global Positioning System (GPS) operation specific to the project and survey and field procedures for documenting artifacts and artifact attributes.

The contracted project included intensive level, site-based survey of approximately 2.77 km² (685 acres), documentation of all sites and reporting. As noted above, areas surveyed were situated in the three individual land parcels within the reserve. These parcels or areas include the Research Natural Area (RNA) parcel (0.93 km² – 229 acres), the Register Rock Parcel (1.19 km² – 295 acres), and the Tracy Lane Parcel (0.65 km² – 290 acres). While the contract required survey transects up to 30 m intervals, the site-based survey for this study utilized 15 m transect spacing.

Table 1. Survey Parcels with Size and Site-based Survey Results.

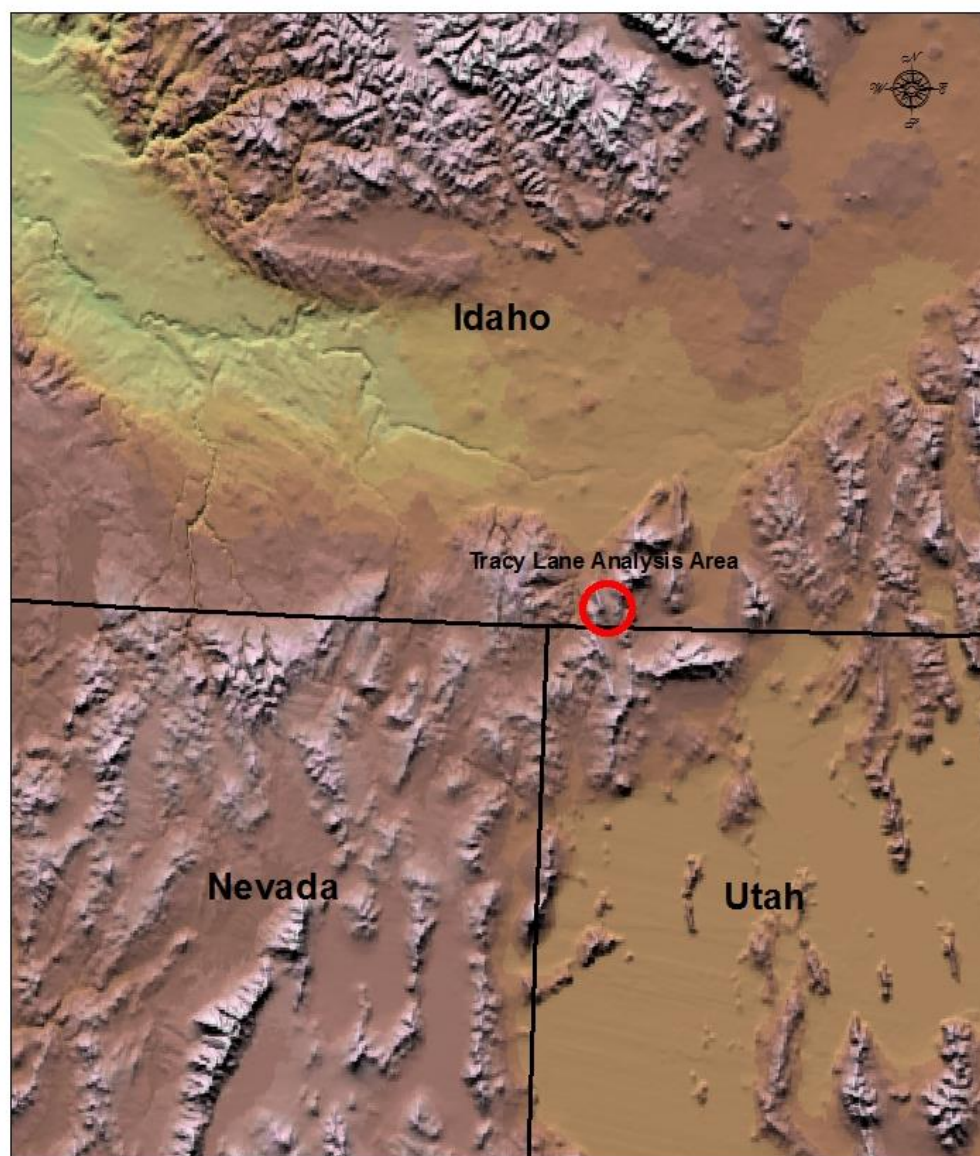
Survey Parcel Name	Acreage	Sites in Parcel	IFs in Parcel
Research Natural Area (RNA)	229	2	1
Register Rock	295	7	3
Tracy Lane	290	4	5

In order to accomplish this project and research needs, the analysis area must meet several criteria. First, the area must contain cultural material. This qualification could not be predetermined. The site-based survey results allowed determination of an appropriate artifact sample for subsequent siteless survey.

Second, this study aims to examine the spatial distribution of cultural materials as detected and defined as sites in a site-based survey versus spatial distribution as revealed through a siteless survey. This examination requires recorded archaeological sites as determined through site-based survey. Next, comparison of detection rates with different transect spacing was deemed paramount for subsequent spatial distribution analyses. For this reason, the parcel selected for comparison needed to provide an area that would

allow field surveyors to walk relatively straight line transects with a minimum of geographic impediments.

In order to reduce surveyor bias, different crew members used in the second siteless survey were not provided with information regarding the preceding site-based survey.



Tracy Lane Analysis Area
Regional View with Shaded Relief

Legend

- USA State Boundary
- Tracy Lane Analysis Area

1:2,000,000

10 5 0 10 20 30 Miles

30 15 0 30 60 90 Km

No warranty is made as to the accuracy, reliability or completeness of this data for individual or aggregate use with other data.
R. McDonald 2015

Figure 3. Regional shaded relief of the Tracy Lane analysis area.

Environmental Context of the Study Area

The City of Rocks National Reserve (CIRO), Idaho is located in southern Idaho three km north of the Idaho and Utah state border (Figure 3). The CRNR sits along the southern portion of the Albion Mountains. The Snake River Plain lies 22 km to the north; the Snake River, which is a dominant landscape feature in Southern Idaho, is located 56 km directly north. Elevation within the CRNR ranges from 1,720 to 2,702 m above the sea level (MSL) (Thornberry-Ehrlich 2010). Broad valleys, including Junction Creek and Upper Raft River Valley bound the study area. Junction Creek, a perennial stream lies 1,000 m to the west of the Tracy Lane parcel.

The geology of the City of Rocks is composed of granite from the Almo pluton, an Oligocene formation, and the Green Creek Complex, that consists of 2.5 billion-year-old metamorphosed rock. Uplift exposed these batholiths, and subsequent erosion created the large granite fins, spires, and domes throughout the City of Rocks (NPS 2010).

The City of Rocks contains three distinct vegetation zones. These are the Big Sagebrush/Grasslands, Mixed Scrub, and Pinyon-Juniper Woodlands. The Tracy Lane parcel consists of the Big Sagebrush vegetation type with some intrusion on the southwest corner of Pinyon-Juniper woodland (Kristen Bastis, personal communication 2014).

Within the Tracy Lane parcel, soils consists of aeolian and alluvial, light brown silty sands and loams (Shults et al. 2014). Ground cover during the surveys was observed

to be sparse; surface visibility was estimated to be 75 percent or greater throughout most areas examined and in areas observed walking to and from survey parcels.

The Moulton town site situated along Junction Creek is less than a km from the study area. The town of Almo serves as the park headquarters and lies east of the CRNR.

Site-Based Survey and Spatial Data Collection Methods

A four-person crew conducted site-based field survey on each of the three parcels in April 2012. The total size of the three parcels was 685 acres. These three parcels are named the Research Natural Area Parcel, the Register Rock Parcel, and the Tracy Lane Parcel. The Tracy Lane Parcel of 161 acres was chosen for this study. Specific information on two parcels not chosen for this analysis, Research Natural Area and Register Rock, are included in Appendix A.

For site-based survey, archaeological sites were defined as five artifacts or more of the same artifact class, or two artifacts of different artifact classes within 30 m of each other. Archaeological features such as historic roads, rock art or historic inscriptions were recorded as a site regardless of artifact presence. Artifacts that did not meet these minimum requirements were recorded as an Isolated Find (IF) even though this was not a requirement for the site-based survey. Artifacts or features in the field determined to be less than 50 years of age were not recorded for this research. Both documented sites and IFs in a State of Idaho Site Archaeological Inventory form accompanied by maps and photographs.

The crew members walked on transects spaced at 15 m intervals. Survey direction was determined in the field and based on perceived ease of survey due to landform obstructions, vegetation or access. Crew members utilized pacing to establish transect spacing between each other.

One assigned crew member had the responsibility for collecting spatial data using a Trimble-XT GPS unit with automatic multi-path error rejection. During site-based survey, transect direction/orientation was controlled and monitored by this crew member. In addition, the GPS unit recorded transects the crew walked (called “not in feature” data or a bread crumb trail).

Field data collection software used was Trimble TerraSync using a generic data dictionary. Artifact locations were collected using the Global Positioning System (GPS) and the Russian GLONASS satellite system under open skies. From now on, this system will be collectively called “GPS” and the equipment called GPS unit. Real-time data correction was employed with the Satellite-Based Augmentation System (SBAS) to a 1-5 m accuracy with a 95 percent confidence rating (2-degree root mean square error or 2DRMS). The raw data accuracy, without any correction, of this system is 15 m. The data was collected to the GPS in decimal degrees using the World Grid System (WGS) of 1984 datum. After field survey was complete, collected spatial data was differentially post-processed using Trimble Pathfinder Office software version 5, to a base station in Park Valley, Utah, which is 1.88 km from the location. The data was confirmed, with 95 percent confidence to be of submeter accuracy. Table 2 shows that nearly 70 percent of the data in the site-based survey was within 50 cm of its actual location on the surface.

Table 2. Global Positioning System Differential Correction Accuracy Report for Site-Based Survey in the Tracy Lane Analysis Area.

Estimated accuracies for 85129 corrected positions are as follows:	
Range	Percentage
-----	-----
0-15cm	19.73%
15-30cm	20.53%
30-50cm	29.70%
0.5-1m	22.04%
1-2m	5.77%
2-5m	1.68%
>5m	0.55%

Differential correction complete.

When crew members discovered cultural material, survey ceased, and more intensive investigations near the initial discovery commenced using transects spaced at 10 m or less. All detected artifacts were pin-flagged. Formal tools and projectile points were double flagged. Based on these investigations, a determination of whether the detected items met the criteria as a site or an isolated find was made.

If the observed cultural materials met the criteria as a site, the following spatial data collection procedures were employed. First, a site boundary that extended no more than 5 m past any artifact (e.g. buffered area) was mapped using GPS. With the exception of debitage, all artifacts were point-plotted using GPS and given a unique identifier in the GPS file and site form.

The crew established a recognizable landmark as the site datum within the site boundary when available. The datum was described, mapped with GPS, and photographed for future location. Mapping included information on vegetation, drainages, landscape, and modern features for reference.

If the observed cultural material did not meet the definition of a site, the cultural discovery was recorded as an IF with a single GPS point. The point was taken at the artifact or the perceived approximate center of artifacts (for artifact numbers that did not qualify as a site). Appendix B provides the documentation forms used in both the site-based and the siteless surveys to record cultural material attributes.

Site-based survey of the Tracy Lane parcel resulted in the identification of four archaeological sites and five IFs. Based on site-based survey, estimated site density in the Tracy Lane parcel is 6.15 sites per km². Additionally, surface visibility was relatively high and continuous in the Tracy Lane parcel. The Tracy Lane parcel also provided an easily accessible survey area and afforded relative ease to perform straight-line pedestrian survey throughout the parcel.

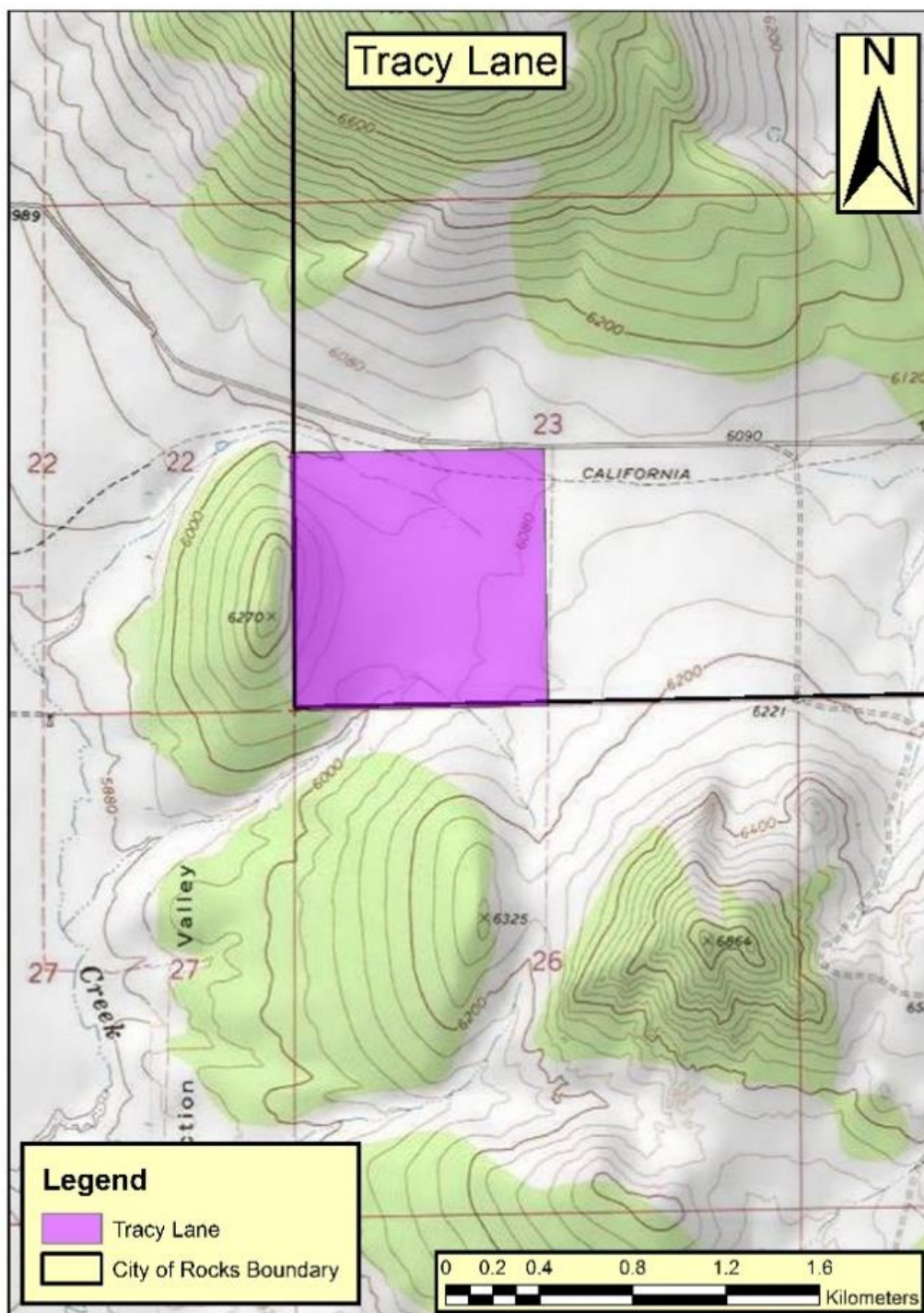


Figure 4. Topographic map showing the terrain of the Tracy Lane analysis area.

Siteless Field Survey and Spatial Data Collection Methods

Prior to initiating siteless survey, results of the site-based survey were reviewed to determine which parcel best met the criteria for selecting a parcel for siteless survey. As previously noted, the criteria for selecting this parcel included presence of cultural material and archaeological sites (as determined by the results of the site-based survey), reasonable ground visibility and ability to conduct straight-line surveys.

Based on the results of the site-based survey, the Tracy Lane parcel provided a suitable area for conducting siteless survey. First, Tracy Lane contained the highest number of sites per km². Second, the topography allowed for straight line survey. Ground cover was consistent and had relatively high surface visibility. Finally, the project area was easily accessed by vehicle on the north end of the survey parcel. Based on these factors, the Tracy Lane parcel was deemed best to meet the requisite criteria for siteless survey.

Siteless survey took place in October of 2012 on the western portion of the Tracy Lane parcel. The surveyed portion measured 455 -x- 1075 -m. Transects utilized north-south orientation. The western portion was selected for the initial survey due to the known presence of isolated finds and archaeological sites as determined by the site-based survey. Active surveying crew members were not used on both surveys. The only individual that participated in both surveys (the author of this thesis) assisted in the classification and documentation of artifacts after initial discovery in the siteless survey.

The siteless survey employed linear oriented transects spaced at five meter intervals. All crew members carried a Trimble Juno SB GPS unit equipped with

Environmental Systems Research Institute (ESRI) ArcPad version 8 software for field data collection. These units are of a lower quality than the GPS units used in the 15 m survey. The only purpose of GPS location was to identify the location of artifacts in the 5 x 5 m grid (not to locate individual artifact locations). These GPS units also collect data using the United States Global Positioning System and the Russian GLONASS system. Real-time data correction was turned on and used the Satellite-Based Augmentation System (SBAS). Correction obtained a 1-5 m accuracy with a 95 percent confidence rating (2-degree root mean square error or 2DRMS). Because the Juno GPS data was not differentially corrected after the survey, it does not retain feature level metadata within each grid cell. The raw data accuracy, without any correction, of this system is 15 m. The data was collected to the Geographic Projection in decimal degrees using the WGS of 1984 datum.

Prior to commencing survey, the Tracy Lane survey parcel was subdivided into cells (GIS polygons) using a fishnet grid with ArcGIS software. The grid cells were 5 x 5 m (25 m²). Each cell within the grid was given a unique numeric identifier, automatically assigned by the ArcGIS, such as G1023. The data were uploaded into each Juno GPS unit.

Placement of survey transects ensured that each grid cell was only intersected once. This placement designated transect spacing with grid cell size. Each member transected a linear row or column within the gridded parcel. Determination of survey orientation occurred in the field. At the conclusion of travel in a single direction, the crew shifted to a new row or column and continued transecting in the opposite direction of the

initial transect. Transect shifting continued until all of the cells had been examined. The Juno GPS unit is not capable of documenting transects walked by each surveyor, so no “bread crumb trail” of the survey transect was available for the 5 m survey.

While the crew chief had previous knowledge of sites and IFs from the preceding site-based survey approach, there was no disclosure to the field surveyors. Additionally, the field director was careful to not provide any verbal or non-verbal cues regarding the presence or absence of cultural materials in areas being examined by crew members.

Collection of spatial data on cultural materials encountered occurred at the individual cell level. Cells that did not contain cultural artifacts required no further action. However, finding cultural artifacts required the surveyor responsible for that cell to stop transecting, tabulate the materials and enter them into the GPS.

Within the field data collection software, ArcPad, a single attribute of presence or absence was assigned to each cell. The assumed designation for all cells was absence. Upon artifact encounter, the value of that cell was changed to “positive” in the database to reflect the presence of artifacts within that cell (see Figure 6).

Unlike the site-based survey, siteless survey did not map vegetation or modern landscape features. An additional form recorded environmental attributes for cells that contained cultural material.

Cultural Material Recordation: Site-Based and Siteless Survey

The following section focuses on a discussion of artifact attribute data collection procedures used in the site-based and siteless surveys. The methods employed to document the attributes of artifacts were the same for both types of surveys to ensure a consistent basis for comparison. Cultural materials recorded during the survey included flaked stone debitage and formal tools.

Attribute data for debitage utilized a standard form in both the site-based and siteless survey (Appendix B). A dedicated crew member was responsible for recording attribute data of all debitage within the field during the site-based survey. During the siteless survey, each member was responsible for documenting attributes of lithic debitage using the same form deployed during site-based survey.

Artifacts defined as formal tools included flaked lithic material including cores, projectile points, bifaces, used flakes, unifaces, and other flaked lithic items not categorized as lithic debitage, and groundstone/groundstone fragments. Because non-lithic artifacts (e.g. bone or wood artifacts), charcoal, fire-cracked rock were not encountered, they are not described here.

Documented attributes of formal tools included material type, artifact type, color, bifacial stage of reduction (stages I-V), and length, width, and thickness. The crews used

standard forms for recording attributes (Appendix B). The form included a text field for adding relevant descriptive information. Both surveys photographed formal tools. Both methods assigned a unique number to each formal tool in both surveys during field recording. Temporally diagnostic projectile points were illustrated in both survey methods.

Debitage and formal tool analysis forms were identical in both surveys except the siteless survey form included contained a field for the grid cell number for debitage and formal tools. These forms are in Appendix B.

Finally, to provide for comparison of cultural materials and their spatial distributions, it was important to utilize similar procedures for documenting physical attributes of cultural material. Consequently, the data and procedures for documenting artifact attributes were essentially identical in both surveys.

CHAPTER IV

PROCEDURES, RESULTS AND ANALYSIS

Results of the two surveys enables comparisons of artifact and distribution and clustering, artifact visibility, and survey methods such as transect spacing. Results discussed here focus on an 80 acre area (referred to as the Tracy Lane analysis area) surveyed by both site-based and siteless survey. Results reported include total artifact densities, cluster and site boundary size and density, and the number and type of detected artifacts. Survey results are used to compare the two survey methods' effectiveness of detecting artifacts; in this comparison, the effects of artifact obtrusiveness/visibility are considered. Results of siteless survey data are examined at different spatial scales to identify clusters and to evaluate attributes of clusters. Analyses of spatial patterning use GIS software including the Getis Ord G_i^* hot spot analysis tool and the buffer tool in ArcMap 10.2. Finally, the results of analysis compare attributes of artifact clusters as identified by the GIS analyses with the attributes of sites.

Site-Based Survey Results

The site-based survey located three archaeological sites (Table 3), and three isolated finds within the 80 acre Tracy Lane Analysis area (Figure 5). Site attributes are summarized in Table 3.

Table 3. Tracy Lane Site Summary.

Site Number	Size	Total Artifacts	Artifact Types	Artifact Density
10CA1745	215.7 m ²	6	Debitage	2.8/100 m ²
10CA1746	222 m ²	4	Debitage, Biface	1.8/100 m ²
10CA1747	55.2 m ²	6	Debitage	11/100 m ²

Total site area ranges from 55 m² to 216 m² with a mean site size of 164 m². Site-based survey located 21 total artifacts. With the exception of a single ignimbrite biface in Site 10CA1746, documented artifacts in site boundaries consist exclusively of flaked lithic debitage. Mean artifact density and the number of artifact types within the three sites are low. Lithic material types documented by the survey within the three sites consist of ignimbrite and chert.

Three isolated finds were documented; two consist of lithic debitage and one isolated find is an ignimbrite projectile point. No prehistoric features were identified by site-based survey.

Tracy Lane Site-Based Survey with Sites and Isolated Finds

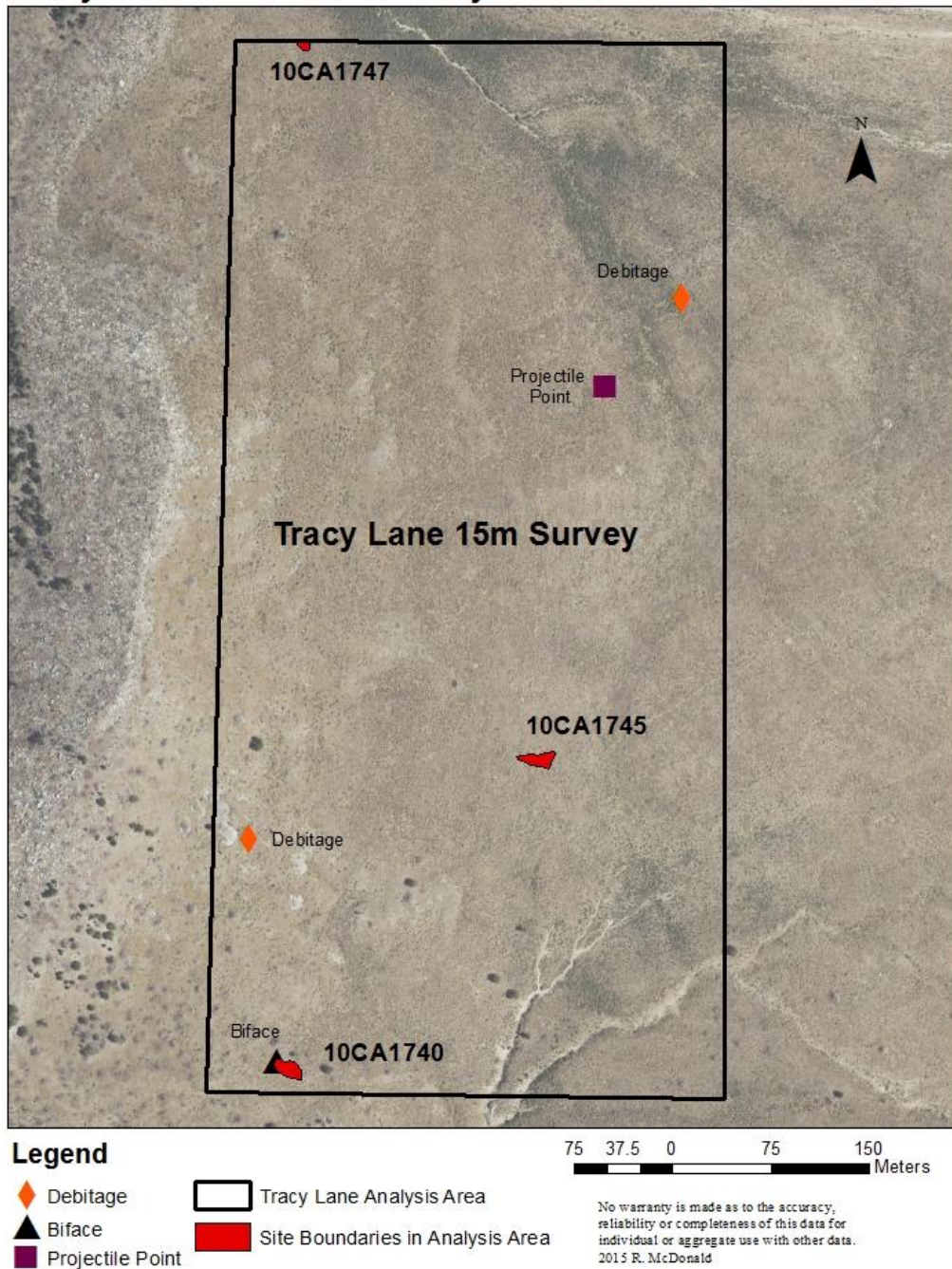


Figure 5. Topographic map showing the results of the site-based survey within the Tracy Lane Analysis Area.

Siteless Survey Results

Siteless survey examined a total of 32 ha (80 acres) divided into 12,447 cells. Cells measured 25 m². Only 32 of the 12,447 cells (0.2 percent) produced positive results for cultural materials. Siteless survey resulted in the documentation of 39 artifacts. As with site-based survey, artifact density within the Tracy Lane analysis area is low. Artifact data for the siteless survey are summarized in Table 4.

Table 4. Siteless Survey Artifacts Summary.

Total Number of 25 m ² Cells Surveyed	Total Artifacts	Debitage	Bifacial Tools	Unifacial Tools	Material Type	Total Density
12,447	39	28	9	1	27- Ignimbrite 7-Chert 5-Obsidian	1.3/10,000 m ²

The majority of the surveyed cells producing positive results for cultural materials are located in the southern portion of the Tracy Lane analysis area (Figure 6). Only 32 of the 12,447 cells (0.2 percent) produced positive results for cultural materials. Density within these cells ranges from one to a maximum of three artifacts per cell.

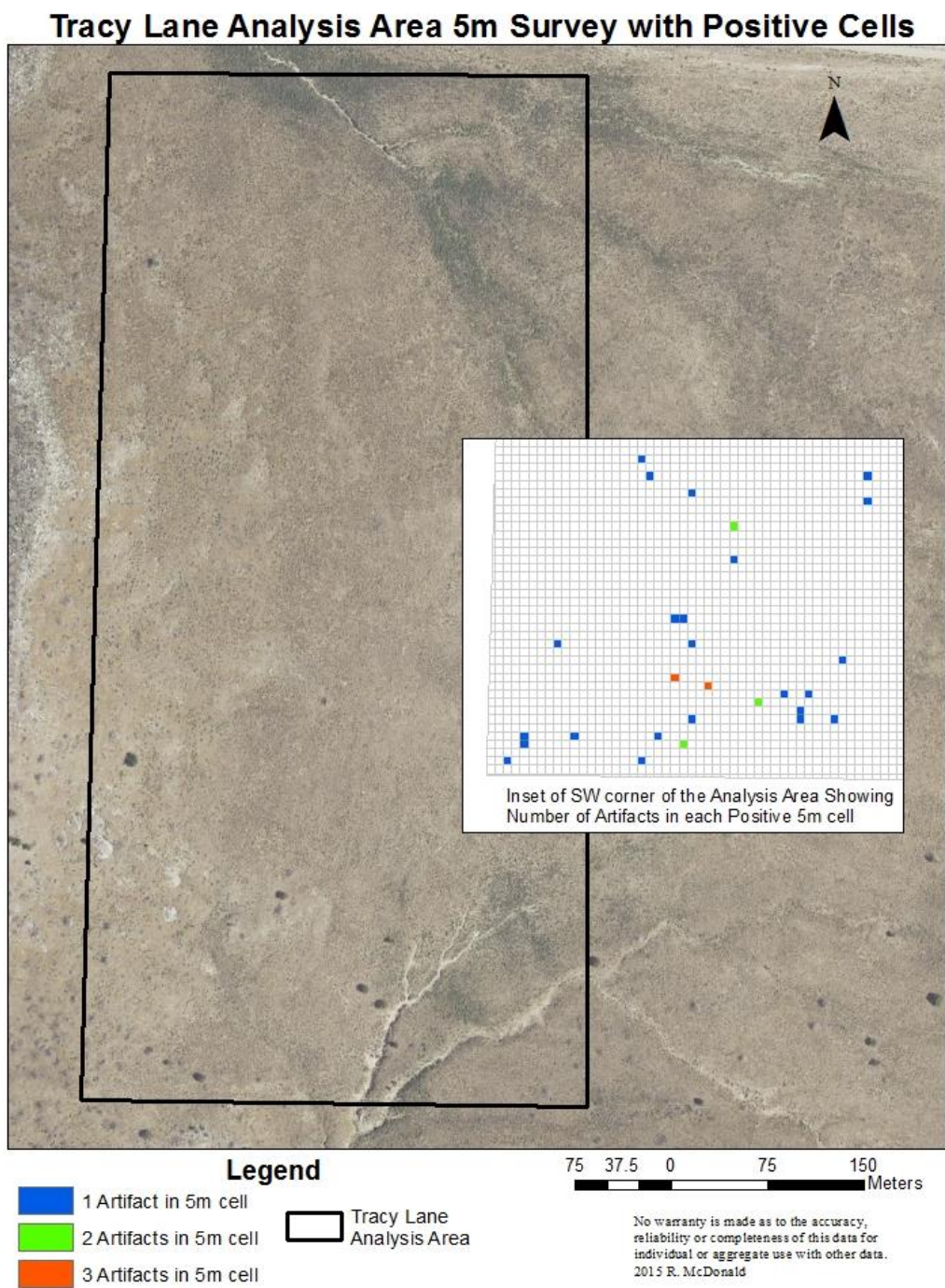


Figure 6. Tracy Lane Analysis Area showing 5 m grid cells with and without artifacts.

Detection of Archaeological Materials: Siteless and Site-Based Surveys

One objective of this study was to examine the effectiveness of each survey method to detect archaeological remains using: (1) controlled transect spacing and (2) a simple measure of artifact obtrusiveness.

In their investigation of the effects of transect spacing on artifact detection, Wandsnider and Camilli (1992:174) assert that an individual surveyor can view approximately 1-2 m of ground surface to either side of their survey transect. Using this assumption, it is expected that individual surveyors in the site-based survey using 15 m transect spacing should only be able to view 14 percent of the surveyed area. Using this same reasoning, surveyors in the siteless survey using 5 m transect spacing will be able to observe 40 percent of the survey area. Consequently, there should be a direct correlation to the number of artifacts discovered by each survey. Using Wandsnider and Camilli's (1992) hypothesis, this study predicts that siteless survey will result in a 26 percent greater detection of total artifacts than site-based survey.

It is important to note that no surveys had taken place within the Tracy Lane analysis area prior to this study. Therefore, no known sample or population of artifacts was available as a basis for evaluating the results of both surveys. While other comparative surveys (e.g. Ebert 1992, Wandsnider et al. 1992) have placed or "seeded" artifacts within survey areas prior to conducting survey as a means of assessing artifact detection, this study uses the cumulative results of the siteless and site-based surveys for this comparison.

As noted previously, siteless survey of the Tracy Lane analysis area detected a total of 39 artifacts while site-based survey located 21 artifacts. Using the cumulative total of artifacts located by both surveys (n=59) as a proxy indicator of the total “known” artifacts within the Tracy Lane analysis area, the results, shown in Table 5, indicate that siteless survey resulted in a 28 percent higher detection rate. These results are consistent with Wandsnider and Camilli’s (1992) hypothesis.

Table 5. Comparison of Artifact Numbers between Site-based And Siteless Surveys in the Tracy Lane Analysis Area.

	Site-Based Survey	Siteless Survey
Total Artifacts	21	39
Percent of Total (n=59) Known Artifacts	36	64
Total Density	0.68/10,000 m ²	1.3/10,000 m ²
Projectile Points	1	6
Bifaces	1	3
Scrapers	0	1
Cores	0	1
Debitage	19	28

To further understand the ability of each survey method to locate artifacts, artifact obtrusiveness was also considered. The obtrusiveness of an artifact is the degree to which its color contrasts with the natural surroundings, thus increasing its visibility. Larger artifacts are expected to be easier to see. Artifact color was employed to assess obtrusiveness. Wandsnider and Camilli (1992), using their controlled study of seeded artifacts (black or tan painted washers and nails), found surveyors identified the most obtrusive artifacts at a 45 percent higher rate than the less obtrusive artifacts.

Survey of the Tracy Lane analysis area encountered two artifact material types, chert and ignimbrite/obsidian. The cherts ranged from mottled white, white, or mottled

gray. Ignimbrite and obsidian artifacts are black. The sediments of the Tracy Lane analysis area are a tan, silty sand. Chert artifacts tended to blend with the natural soil surface whereas ignimbrite/obsidian artifacts contrast with the soil surface.

The combined sample (n=59) indicates that both surveys located the more obtrusive and visible ignimbrite/obsidian artifacts at higher frequencies than the less visible chert. Obsidian/ignimbrite accounts for 66 percent of the artifacts documented by site-based survey and 82 percent of the artifacts recorded by siteless survey (Table 6).

Table 6. Material Type by Survey.

	Site-Based Survey	Siteless Survey
Total Artifacts Ignimbrite/Obsidian	14	32
Total Artifacts Chert	7	7

The less intensive site-based survey method resulted in a higher discovery rate of the less visible chert artifacts. Chert comprises 34 percent of the artifacts documented in the site-based survey and 18 percent of the artifacts detected by siteless survey. Such a conclusion runs counter to the expectations of Wandsnider and Camilli (1992) regarding transect spacing and artifact visibility. Because the actual population of artifacts is unknown, it is possible that the differential discard of ignimbrite/obsidian and chert artifacts account for the greater number of ignimbrite/obsidian artifacts. For these reasons and the small sample size, these results must be interpreted cautiously.

An unexpected result of this study is that a single artifact, an ignimbrite biface (located within Site 10CA1746) constitutes the only artifact located by both surveys. In other words, siteless survey located only one of the 21 artifacts documented by the site-

based survey while the site-based survey located only one of the 39 artifacts located by the siteless survey.

Geographic Information Systems (GIS) Analyses

ArcGIS analytical tools provide measures to quantify the degrees of artifact clustering and dispersion, which is another objective of this study. The ArcGIS suite of analytical tools includes the Getis Ord G_i^* hot spot method and the buffer tool in ArcMap 10.2. These tools provide measures (1) to identify clusters and (2) to statistically determine if such clustering is random. Once clusters are identified, comparison of cluster attributes with site attributes is undertaken.

Getis Ord G_i^* Hot Spot Analysis

The Getis Ord G_i^* spatial software analysis tool is used to identify statistically significant hot and cold spots (ESRI 2015a). Within ArcMap, this tool identifies hot spots, or spatial clusters, as indicated by strongly positive Z scores with low p-values. The tool also identifies cold spots or spatial isolation, by strongly negative Z scores with low p-values. The Getis Ord G_i^* tool uses Z scores and p-values to analyze the statistical significance of spatial clustering of the measured variables (ESRI 2015a).

Z scores and p-values identify when the null hypothesis is rejected. The p-value is a measure of probability that the sample is not due to the vagaries or unexpected and inexplicable change of sampling (Drennan 2009). The vagaries of sampling can be due to natural or cultural practices, but are likely the result of a flawed research design or improper identification (Drennan 2009). While the p-value can have a wider range, p-

values are typically between 0.1 and 0.01 in order to measure probability. A p-value of 0.01 indicates a 99 percent probability that the result is not due to the vagaries of the sample. A .10 p-value indicates that there is a 90 percent probability that the result is not due to the vagaries of the sample (Drennan 2009, ESRI 2015c).

The Z score is the standard deviation. The standard deviation allows a sense of how dispersed the information within the dataset is from the mean of the sample population (Ebert 1992, ESRI 2015c). In other words, when the Z score is higher, the standard deviation is greater, and the value being measured within the cell is more dispersed, or clustered from the mean.

In this analysis, the Getis Ord G_i^* tool calculates the influence of different distance thresholds on the measure of clustering and isolation (ESRI 2015b). The tool calculates standard deviation and p-values for every cell within the grid based on predefined spatial constraints (ESRI 2015c). Getis Ord G_i^* utilizes the p-values and Z scores to identify features with high or low values with a correlated probability that the sample is not due to the randomness of sampling (ESRI 2015a). The subsequent analysis identifies hot and cold spots, with mapped results. (ESRI 2015a). Both higher and lower Z scores indicate intense clustering while a Z score near zero indicates that there is no apparent spatial clustering (ESRI 2015c).

The key to the Getis Ord G_i^* tool is to vary the distance bands or threshold distances. These distances do not consider any feature for clustering outside of this distance (ESRI 2015b). In this study, the Getis Ord G_i^* analyses were performed using distance thresholds of 15 m, 50 m, 100 m, 200 m, and 400 m using the same 5 x 5 m grid feature class of the entire Tracy Lane analysis area. The cell count attribute in this feature

class identified the number of artifacts (e.g. either 0, 1, 2, or 3 artifacts) within each cell. This information for each cell is entered into an attribute column. No null cells are allowed in this attribute column of the table in these calculations.

Utilization of the Getis Ord G_i^* software tool within ArcMap requires the sample to contain a variety of numerical values. The math required for the statistic cannot operate on input that only contains a single value and requires a minimum of two values (i.e., at least two cells with different totals) (ESRI 2015a). Additionally, the tool requires the designation of either Euclidean or Manhattan distance. This project chose Euclidean distance because it is a straight line, while Manhattan distance must use a series of straight lines and 90° turns (ESRI 2015b). The Getis Ord G_i^* tools also create a centroid or label point, for each cell polygon at the different scales with the numerical p-values and Z scores attached to the point.

An option also exists to allow the Getis Ord G_i^* tool in ArcMap to calculate the optimum (Getis Ord G_i^* Optimized) distance threshold for computation (ESRI 2015a). ArcMap utilizes the incremental spatial autocorrelation tool at increasing spatial distances to calculate the optimized distance. The tool analyzes the local Moran's I statistic which analyzes Z scores at varying levels to identify peak clustering. The peak is considered the scale of analysis (ESRI 2015d). This study ran the optimum scale of the original 5 x 5 m cell size and calculated an optimum threshold distance of 44 m. This distance of analysis and peak in Z score suggests that clustering for the entire analysis area is at the highest level.

In the following figures, the Getis Ord G_i^* tool shows maps of hot-spots or clusters of positive artifact cells, at varying scales. The Z score is the measure used to identify clustering in the images.

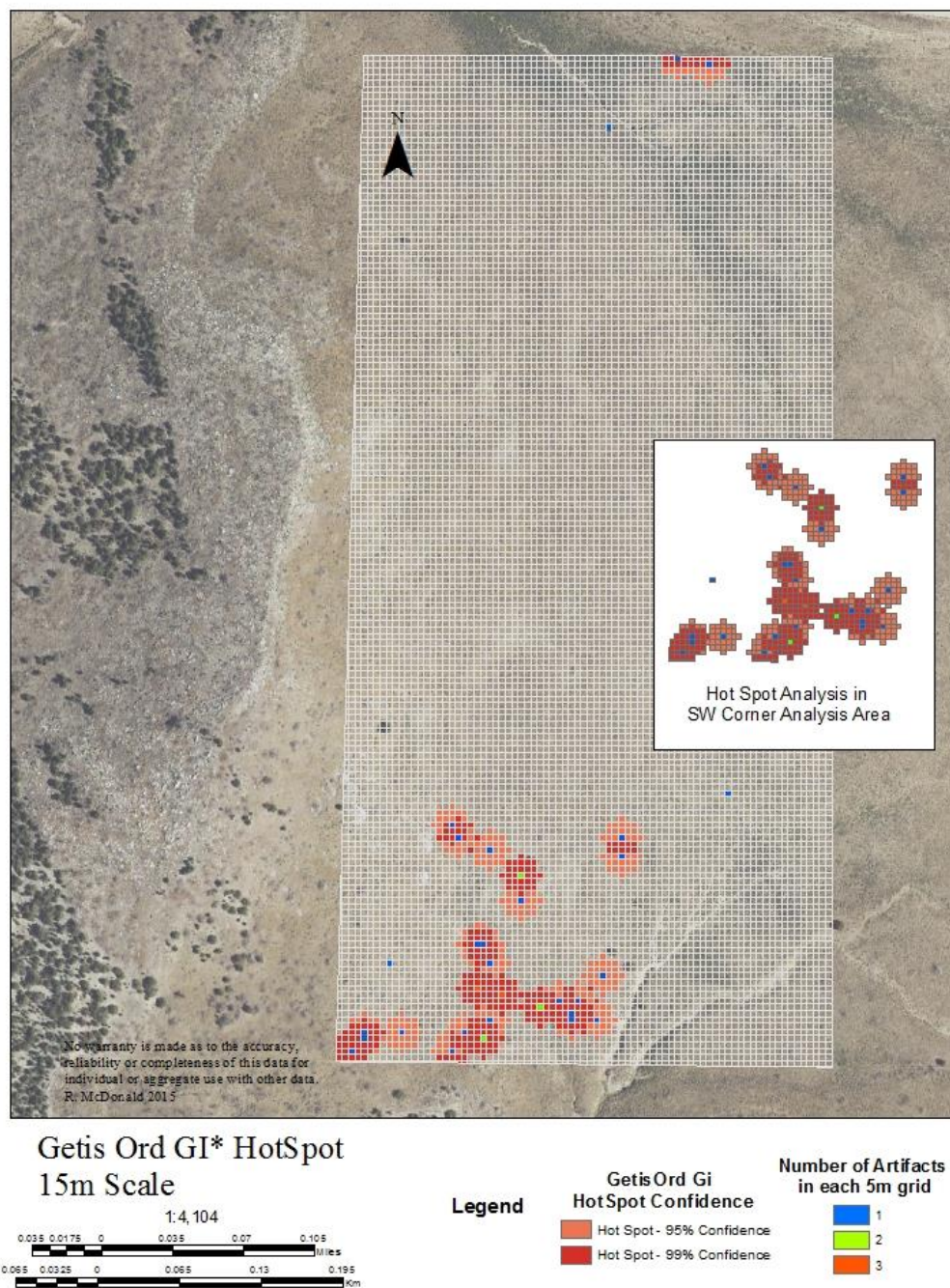


Figure 7. Getis Ord Gi* hot spot analysis at 15 m scale.

At the Getis Ord G_i^* 15 m (and all other spatial distances) analysis level, every artifact contains a sphere of influence (Figure 7). Clustering appears isolated, and artifacts have limited ability to influence other artifacts if they are spatially distant. This is the distance utilized for cluster analysis due to the similarity of spatial separation allowed for artifacts to identify clusters of all other methods, including the site-based survey.



Figure 8. Getis Ord Gi* hot spot analysis at 50 m scale.

At the 50 m spatial level (Figure 8), individual artifacts lose their ability to create discrete hot spots such as those in Figure 7 at the 15 m scale. However, as the scale of analysis (cell size) is increased, the values of cells may increase due to encompassing more artifacts within a cell. It is only the artifact's spatial relationship or the total number of artifacts within a cell that allow the determination of hotspots based on Z scores. A large cluster is noticeable in the southwestern corner of the Tracy Lane analysis area. Positive cells in the northern part of the analysis area are identified as a hotspot by the Getis Ord G_i^* analysis. Note that the hotspot within the northern portion of the Tracy Lane analysis area lies entirely between two cells containing artifacts but does not extend to the physical location of any of these cells.

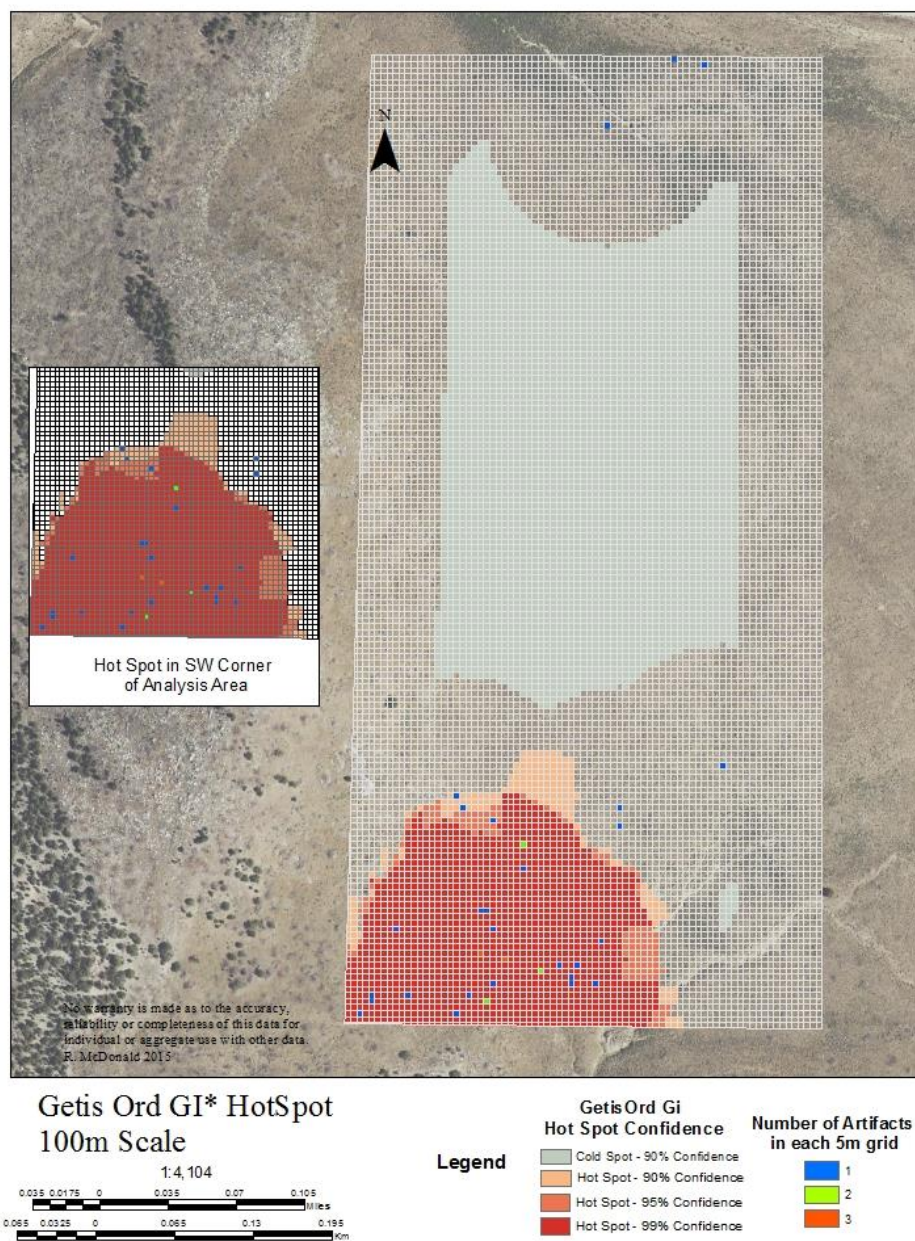


Figure 9. Getis Ord Gi* hot spot analysis at 100 m scale.

At the 100 m spatial level (Figure 9), the cells containing artifacts in the northern portion of the Tracy Lane analysis area no longer have the strength required to create any level of clustering based on Z scores. The first cold-spot (seen in the center of the map) reduces in size due to the presence of artifacts in the north. The hot-spot to the south continues to amass. The artifacts in the north end of the analysis area are not within a hotspot.

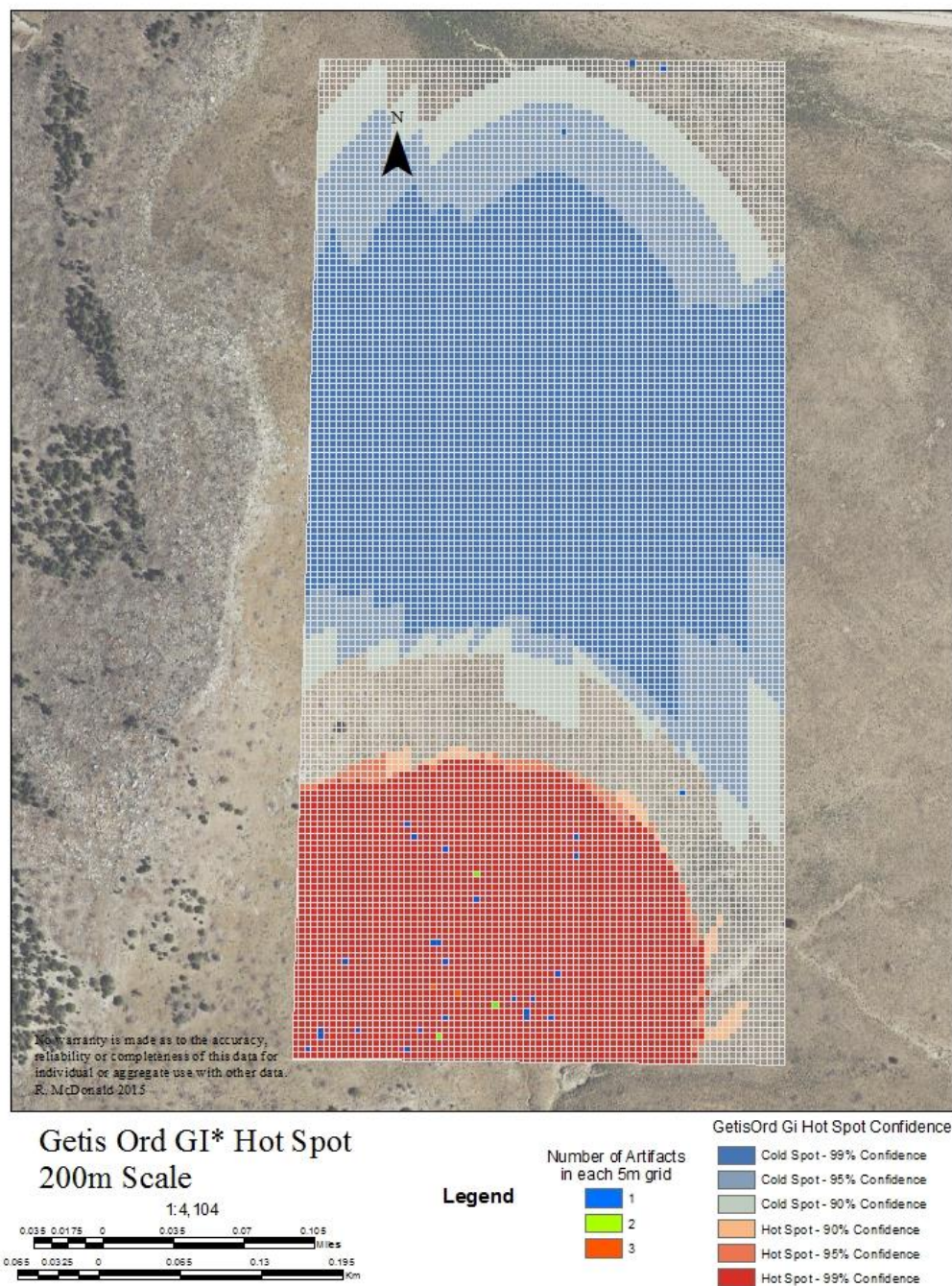


Figure 10. Getis Ord Gi* hot spot analysis at 200 m scale.

At the 200 m scale of analysis (Figure 10), positive cells in the south maintain the same approximate shape as at the 100 m scale as shown in Figure 9. However, the hotspot has increased in size, and the edges drop sharply from 99 percent confidence to non-significant levels. The cold spot at this level is also the first 99 percent significance level revealed through the analysis. Additionally, one of the cells containing a single artifact along the northern portion of the survey is enveloped in a 95 percent confident cold spot. At this scale, artifact presence alone is not enough to override the spots. Instead, the number of artifacts and their relationship to each other has greater ability to influence measures of clustering.

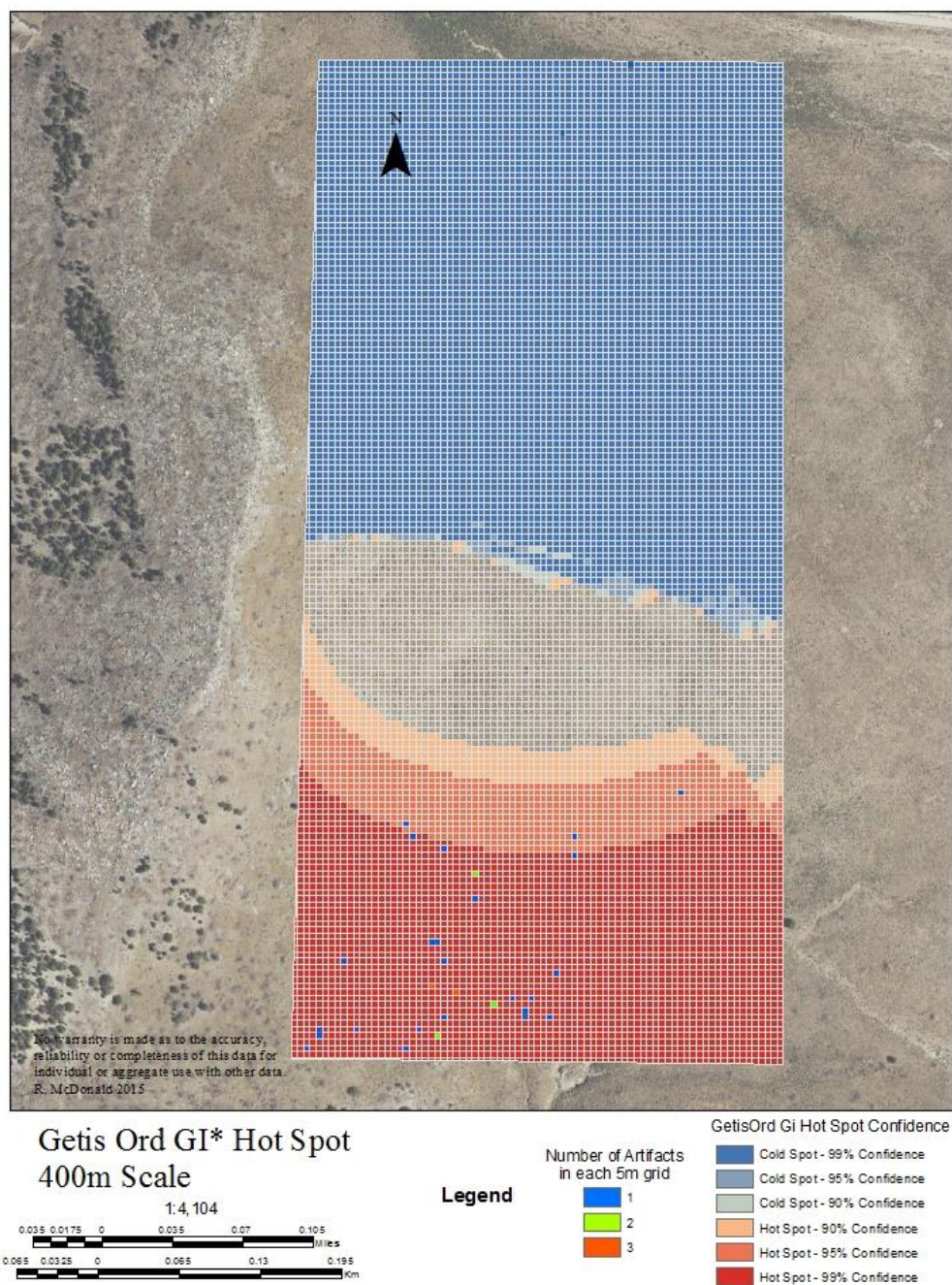


Figure 11. Getis Ord Gi* hot spot analysis at 400 m scale

At the 400 m scale (Figure 11), the survey parcel has been clearly divided by a hot spot in the southern third of the project area. There is a cold spot in the northern third with a thin band of a neutral zone running through the center of the entire analysis area. Cells containing artifacts near the center of the area are also beginning to lose confidence that they are within the cluster. The clustering to the very southern end has become more contained within the area only containing higher numbers of artifacts.

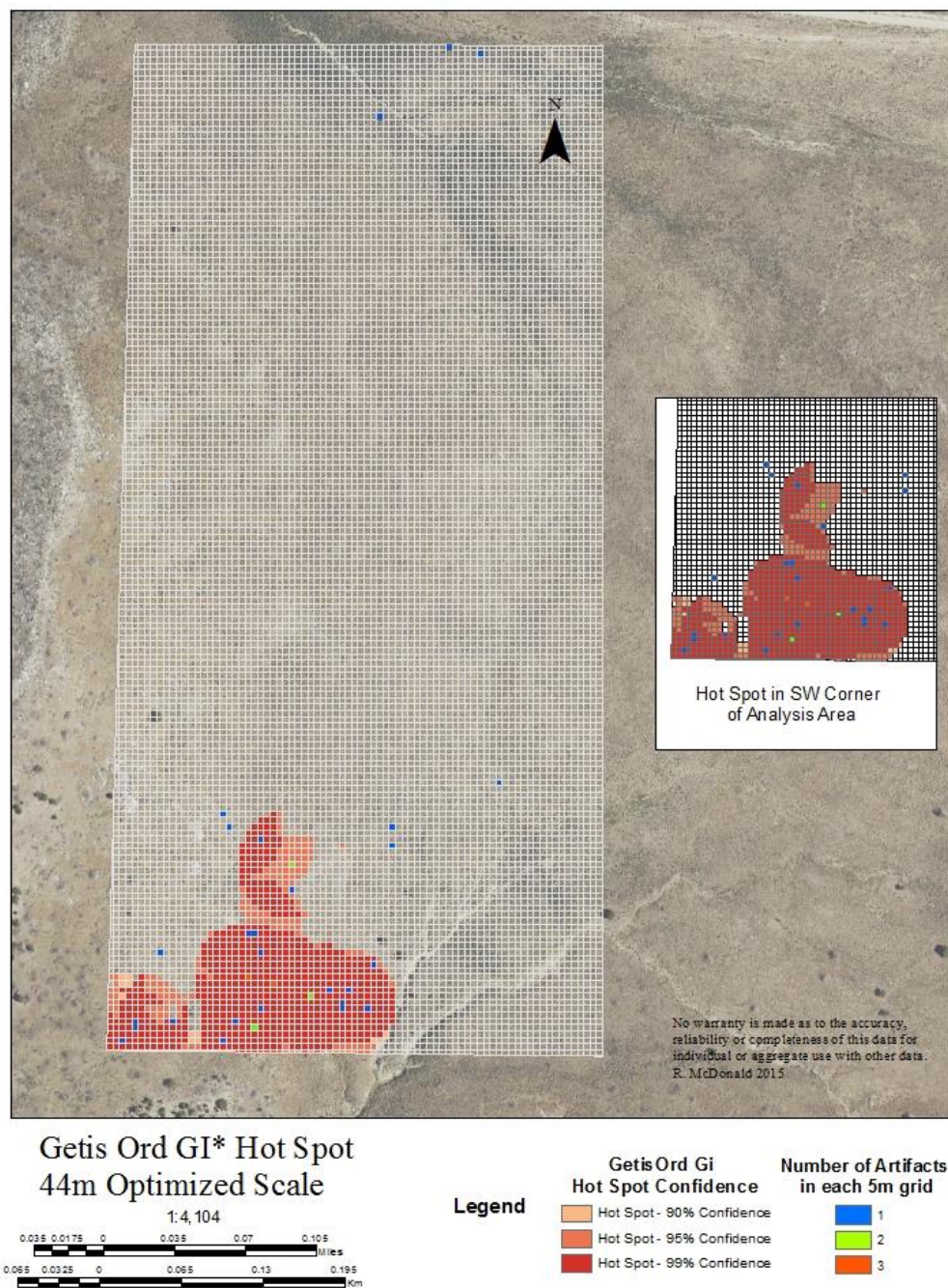


Figure 12. Getis Ord Gi* hot spot optimized analysis at 44 m scale

In addition to its tools to analyze clustering at varying spatial scales, Getis Ord G_i^* software contains tools to calculate the optimal scale of clustering. The Getis Ord G_i^* Optimized analysis uses Local Moran's I statistic to identify the peak Z score. The highest Z score represents the peak measure of clustering in the Getis Ord G_i^* (Figure 12). This research discovered that the optimized parameters at a 44 m scale eliminated a hotspot identified in the northern portion of the Tracy Lane Analysis Area that contains no artifacts (see Figure 8 Getis Ord G_i^* at 50 m scale). The Getis Ord G_i^* optimized tool allows for the identification of the peak level of clustering, while also attempting to eliminate hot spots that don't actually contain any positive cells. Therefore, the Getis Ord G_i^* Optimized tool seems to be a valid tool when assessing artifact hot spots on the landscape. The only requirement is that the survey sample, large or small, current or historic, site-based or siteless, point plot artifacts.

Getis Ord G_i^* also allowed for manual spatial distance calculation for hot and cold spots. While cold spots were not identified at every level of analysis, Getis Ord G_i^* did identify hot-spots at all scales. These analyses allow archaeologists to quantitatively compare the degree that artifacts are grouped within hot or cold-spots and allows for standardized comparison of data when artifacts are spatially plotted.

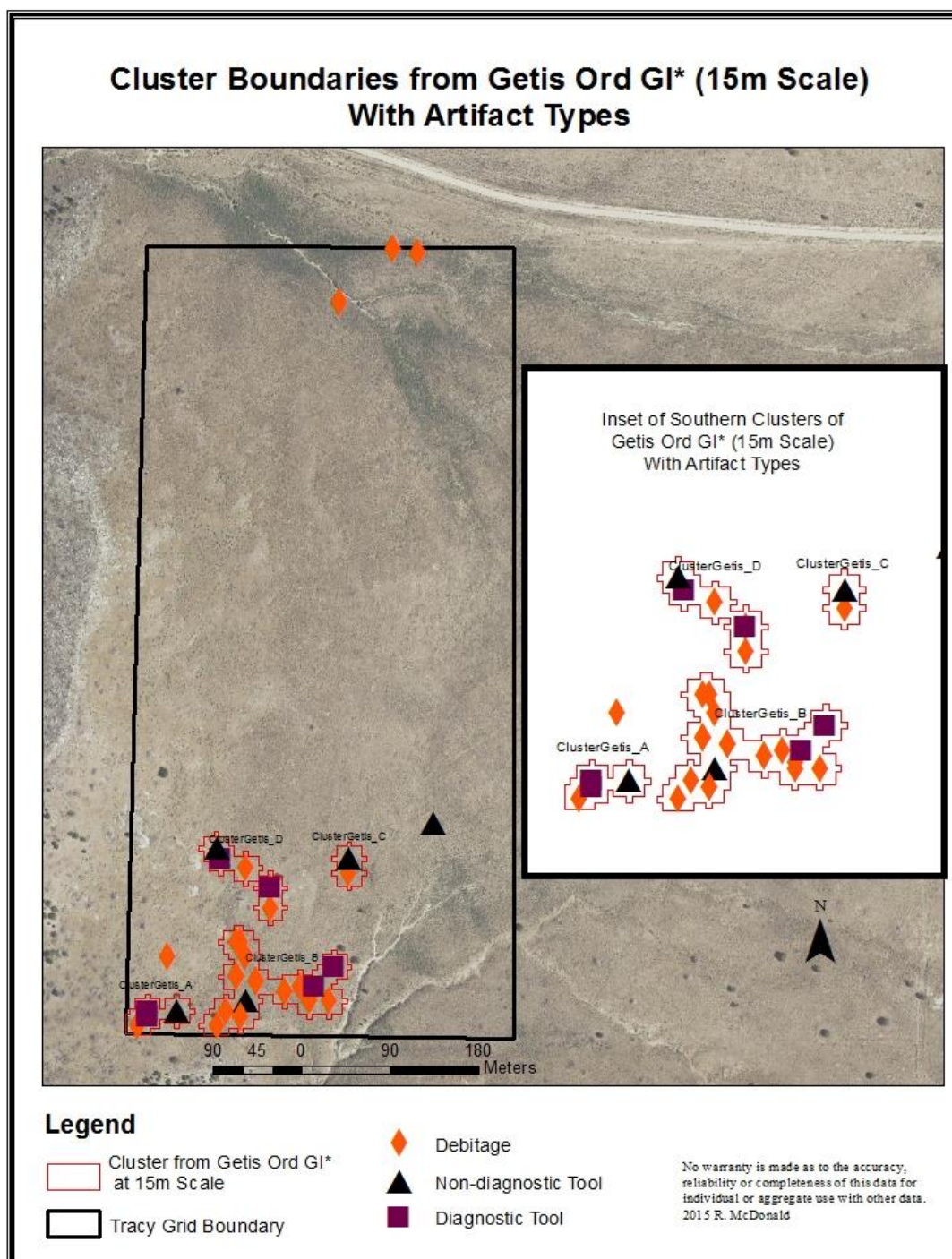


Figure 13. Preferred Getis Ord Gi* 15 m cluster boundaries showing artifacts.

In addition to identifying hot and cold spots of clustering, Getis Ord GI* can be used to identify the boundaries of artifact clusters using the same site definition criteria employed in the site based survey for this study. Figure 13 displays the results of identifying cluster boundaries using the criteria for sites from the site-based survey.

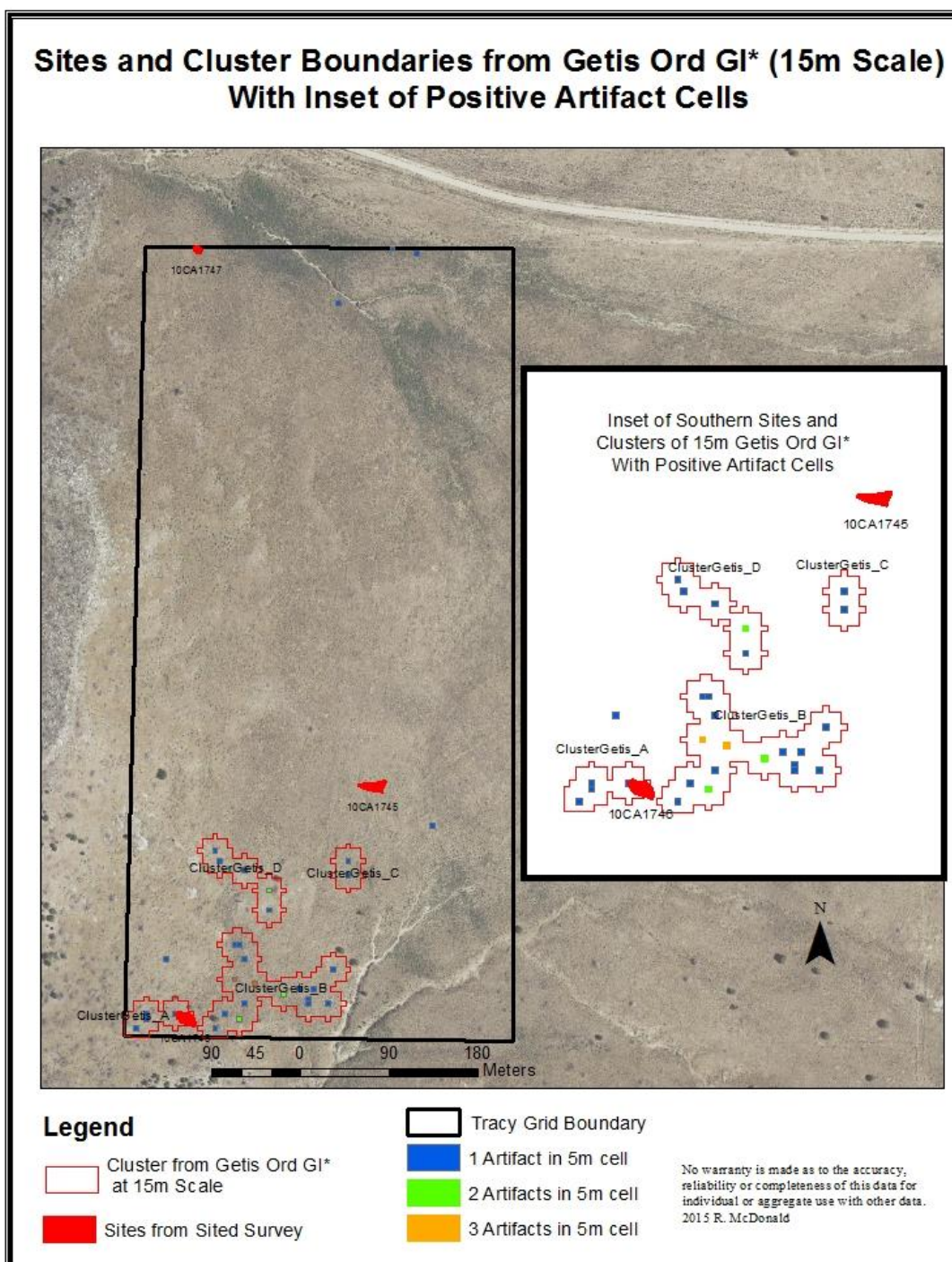


Figure 14. Map showing Getis Ord GI* 15 m cluster boundaries and site-based boundaries using similar boundary parameters.

In Figure 14, the definition of a site was applied to the Getis Ord GI* results at the 15 m scale. Four clusters were identified, labeled A, B, C and D in Figure 14 because these clusters have at least one diagnostic tool and one piece of debitage within 15 m of one another, the criteria used in site-based survey.

The Getis Ord GI* tool was effective at identifying clustering at all scales analyzed in this study. The optimized scale might be effective in analyses when there are no defined scales or parameters for the definition of boundaries.

Artifact Buffering Analysis

Buffering tools within ArcMap 10.2 provide a second technique to identify clusters using data collected by siteless survey. Cells containing artifacts are the primary spatial unit of analysis for the ArcMap 10.2 buffering analysis.

The identification of spatial clusters using the Arc Map 10.2 buffering tools required that artifacts had to be found within 30 m of another artifact in order to be considered as a potential cluster. In addition, if a potential cluster did not contain five or more pieces of debitage, or two artifacts of different artifact classes (e.g., one projectile point and one piece of debitage), it was removed from further cluster consideration in the buffering analyses.

The first step in this process was to create a cell buffer of 15 m around all positive cells (cells with artifacts) within the siteless survey method. In this process, the outside edges of each 5 x 5 m positive cell were buffered by 15 m. When the boundaries of two or more of these buffered areas overlapped, a grouping was identified. Each grouping was then examined to determine if it contained at least one tool and one piece of debitage

or five pieces of debitage. Groupings meeting the site definition were designated as clusters. In this way, buffering identified clusters with the same criteria used for defining sites in site-based survey.

Seven initial groupings were identified. One grouping did not meet the cluster criteria. This resulted in six groupings meeting the criteria for designation as a cluster. Each intersecting grouping was classified in the attribute table with a cluster letter labeled A-F. By using the ArcGIS Dissolve tool based on the cluster letter attribute, boundaries between intersecting buffers were erased. The result is that each of the six clusters only retained the outer boundary of the cluster polygon.

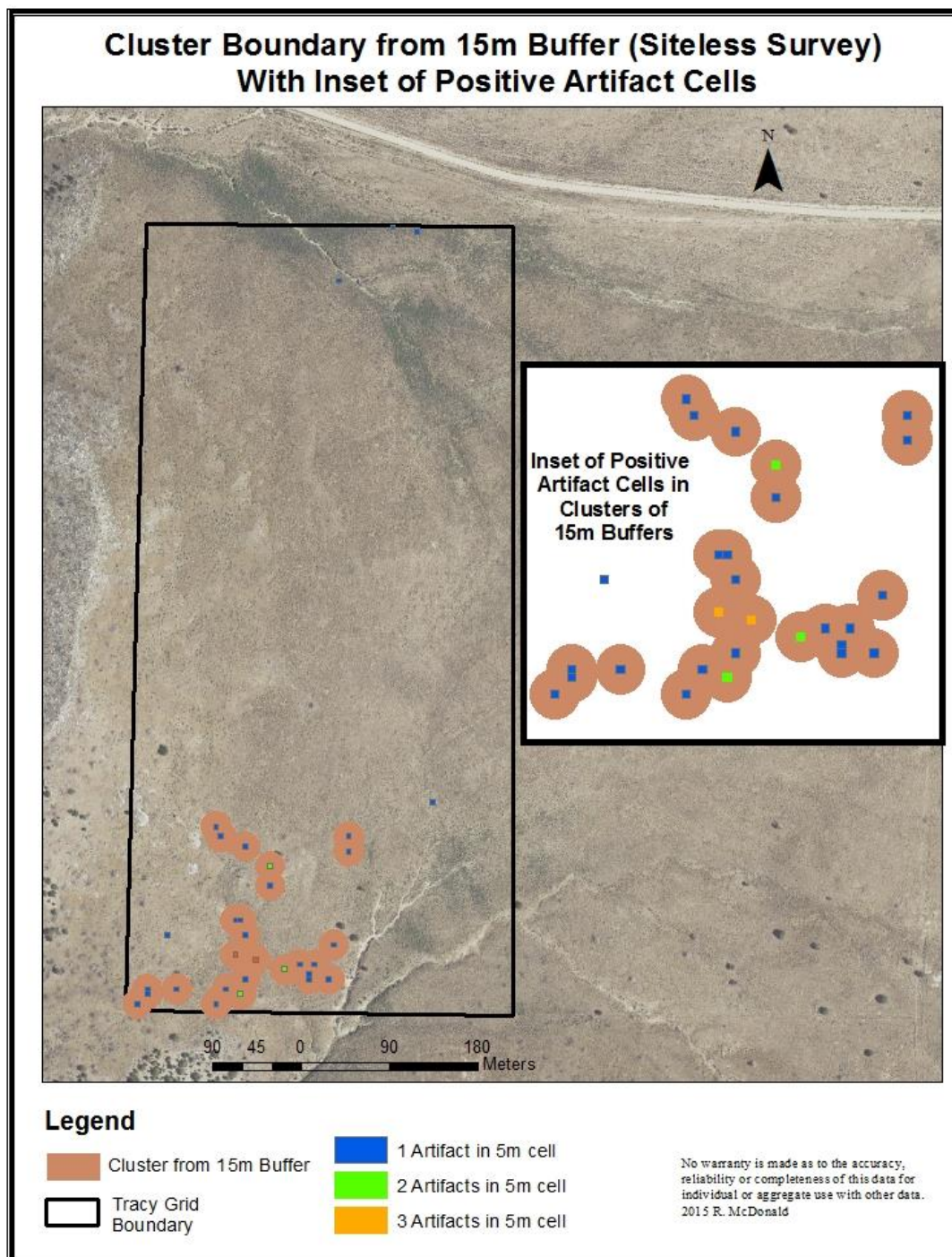


Figure 15. Map of cell buffers.

Figure 15 shows the buffering method with the positive cell in the center. The cell color denotes the number of artifacts located within each cell. By simply buffering each 5 meter cell by 15 meters, one can begin to discern a potential cluster pattern. In other words, it might be hypothesized that if a polygon were to be drawn around clumps where buffers touch or overlap each other, that polygon might be described as a cluster. Just by viewing the graphical representation of the buffered cells in the inset of Figure 15, one might suggest that there are six clusters. This cluster pattern, in fact, will closely mimic the Getis Ord 15 meter scale results.

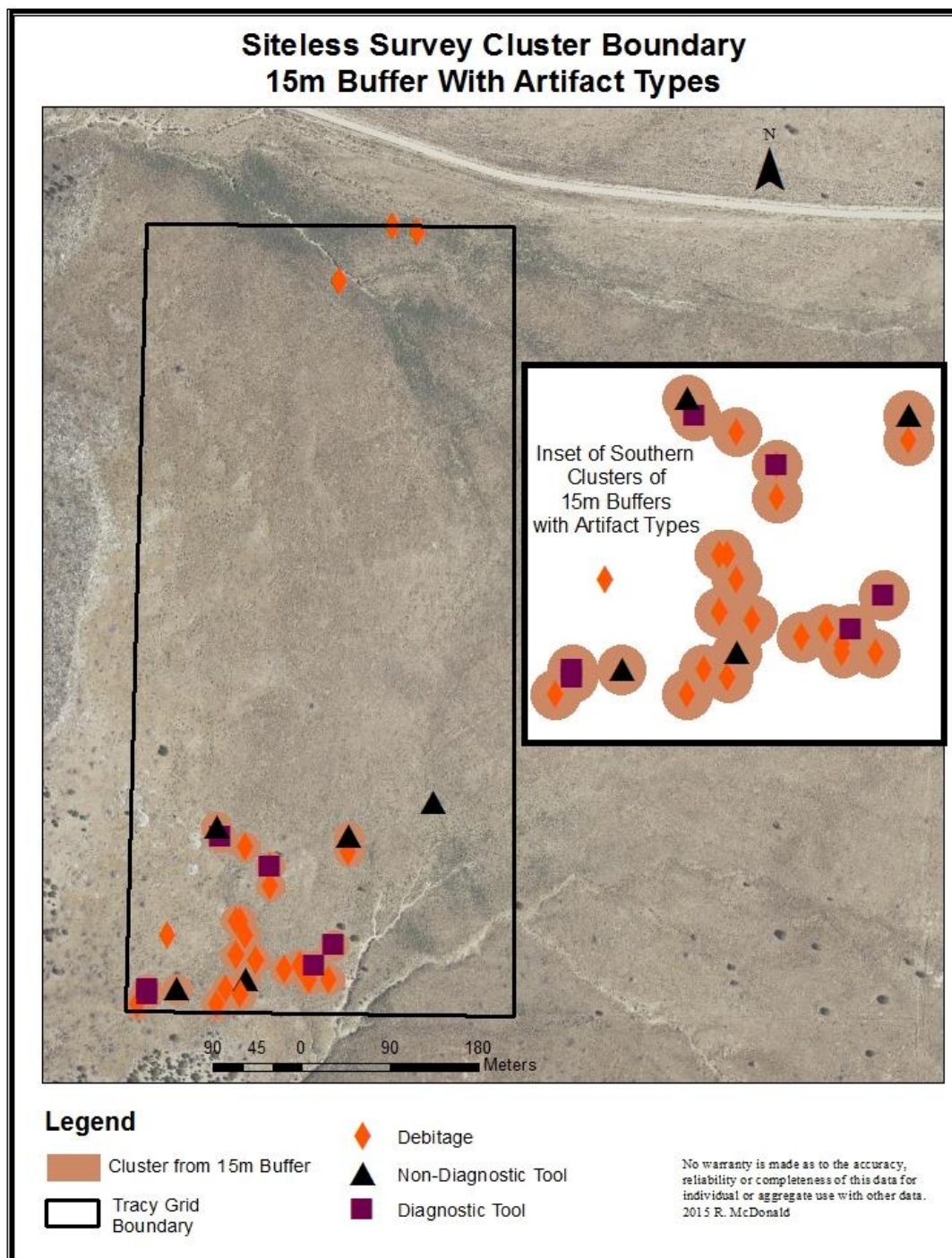


Figure 16. Map of cell buffers with artifact types.

Figure 16 symbolizes the artifact type in each cell. The artifact types are importantly used to imitate the traditional site boundary rules in this study. That is, a site must have at least two artifacts within 15 meters of each other and at least one artifact must be a tool (either diagnostic or non-diagnostic tool). This rule is also applied to the siteless survey. By looking at the inset for Figure 16, one can see that each of the hypothesized six groupings has at least two artifacts with at least one of those artifacts shown to be a tool. Therefore, the hypothesis might hold, that six clusters are found in the siteless survey just by simple buffering of each positive 5 meter cell, connecting the resulting coincident polygons, and eliminating those groupings that do not contain at least two artifacts with at least one tool artifact type.

Comparison of Cluster and Site Attributes

GIS analyses enable the identification of artifact clusters for comparison of the identification of bounded sites. These data include the size of clusters/sites and attributes of artifacts within cluster/sites. As shown in Table 7, attributes of clusters identified by the two GIS clustering techniques display similarities (Figure 17). The two measures of clustering provided similar total area of clustering and contained a high rate of cluster overlap. Both Getis Ord G_i^* and the buffering techniques resulted in the identification of four and six clusters respectively whereas site-based survey identified three sites. Next, the mean size of GIS clusters and sites are dissimilar. GIS clusters are significantly larger in size than sites in all cases and by several orders of magnitude.

Artifact density is lower in the clusters than in sites; however, this is expected because clusters are larger than the identified sites. Both GIS clustering methods also identify a higher mean number of artifacts per cluster than in sites. Interestingly, the diversity of artifact types within the clusters identified by both GIS methods is greater than artifact diversity within sites. This suggests a greater potential for the GIS clustering techniques to identify spatial limits of areas exhibiting a wider range of cultural activities.

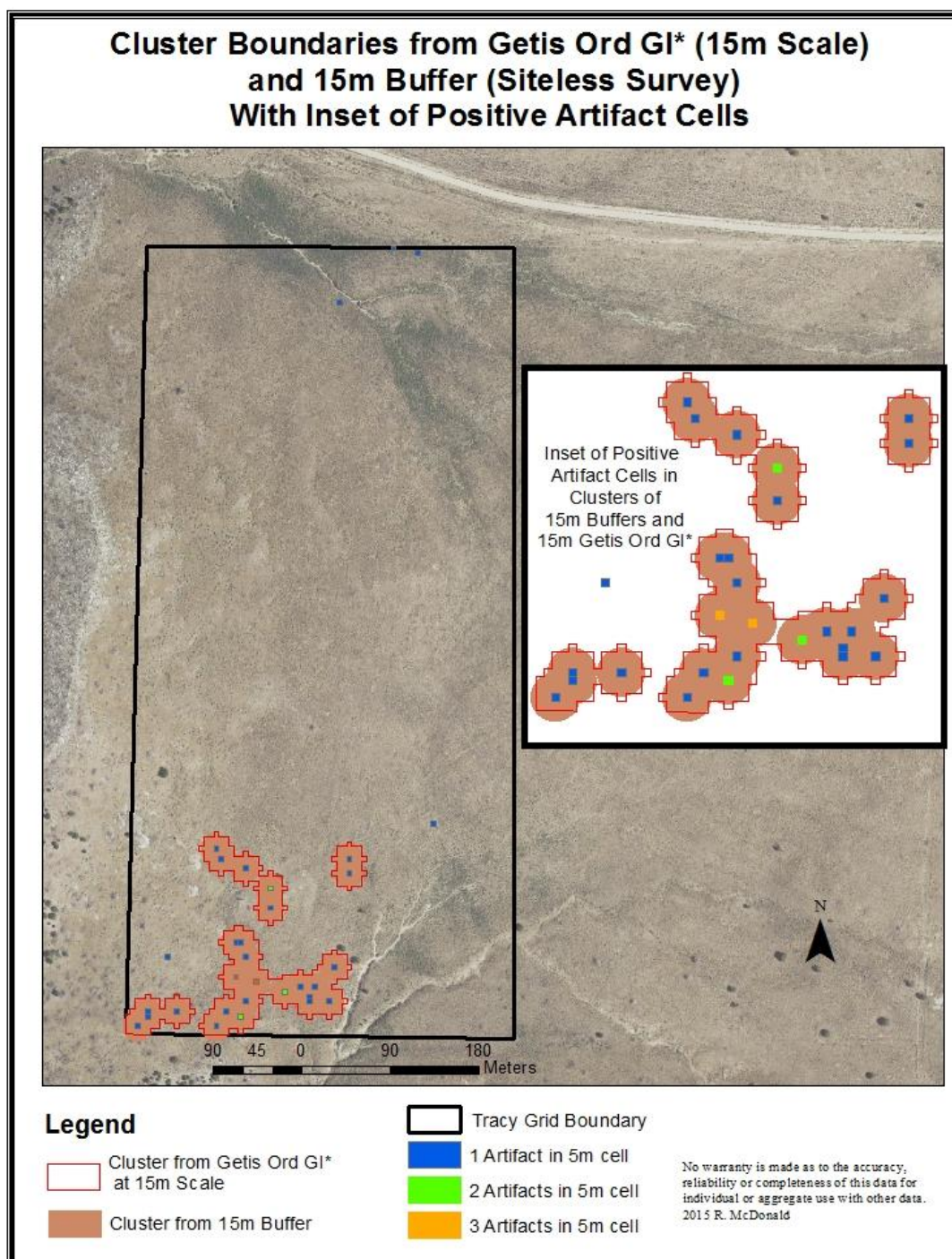


Figure 17. Getis Ord Gi* 15 m cluster boundaries and 15 m buffer boundaries.

Table 7. Comparison of artifact clusters as determined by site-based survey; Getis Ord Gi* Hot Spot Analyses and GIS ArcMap 10.2 buffering techniques.

Description of Statistic	Sites(Site-Based Survey)	Getis Ord Gi* Clusters (Siteless Survey)	ArcMap 10.2. Buffered Clusters (Siteless Survey)
Total Area of all Clusters or sites m ²	493	13,610	13,639
Total Number of Clusters or Sites	3	4	6
Mean Size of Clusters or Sites /m ²	164	3402	2273
Range of Cluster or Site Size/m ²	55.2-222	1150-7620	1137-4411
Total Artifacts	16	34	34
Range of Artifact Count	4-6	2-22	2-14
Mean Number of Artifacts	5.3	8.5	5.6
Mean Number of Artifact Types	1.33	2.75	2.33
Total Artifact Density per 100 m ²	3.2	.250	.249
Number of Artifacts not in Cluster/Site	5	5	5

Summary

This study compares site-based and siteless survey of an 80 acre area using the following field procedures:

- (1) Controlled but contrasting transect interval spacing.
- (2) GPS/GIS plotting of artifact locations.
- (3) Identical artifact documentation procedures.

(4) Different crew members in each survey to reduce surveyor bias.

A primary objective of this study is to determine if siteless survey and GIS analyses can identify spatial patterning not identified by site-based survey. Secondary objectives include a comparison of transect spacing and artifact obtrusiveness.

Site-based survey identified three sites and three isolated finds. Siteless survey documented artifacts in 32 of the 12,000+ 5 x 5 m cells. Initial examination suggests that both surveys resulted in the identification of dispersed, low density artifacts.

Prior to analyzing spatial patterning, the effects of transect spacing and artifact obtrusiveness on artifact detection were examined. The site-based survey identified 21 artifacts; siteless survey identified 39 artifacts. The results of this study support Wandsnider and Camilli's (1992) expectation that survey using 5 m transect spacing results in a 26 percent higher detection rate than surveys using 15 m transects. In this study, siteless survey (5 m transect spacing) resulted in a 28 percent higher detection than site-based survey (15 m transect spacing). However, the expectation that siteless survey will better detect less obtrusive artifacts due to increased survey intensity was not met. Due to the small sample size, further inferences regarding the effectiveness of the two methods to detect artifacts based on artifact obtrusiveness cannot be made.

The analyses of spatial patterning employed GIS software and tools including Getis Ord G_i^* hot spot and buffering tools within ArcMap 10.2. In addition to identifying clustering, the attributes of clusters are also described.

Analyses using Getis Ord G_i^* hot spot examined spatial patterning at 15 m, 50 m, 100 m, 200 m and 400 m spatial scales. Getis Ord G_i^* identified hot-spots, or clustering

based on p-values at every scale. Getis Ord G_i^* Optimized determined that the peak Z score or hot-spot rate was at 44 m. In summary, Getis Ord G_i^* was an effective tool at identifying hot spots at all scales, but calculated a peak or optimized hot spot analysis at 44 m. These analyses are relevant when looking at other similar studies in order to discern peak levels of clustering on landscapes.

GIS buffering provided a second analytic method to identify artifact clustering. In this method, the 15 m buffer around positive artifact cells to identify clusters used the same artifact count, assemblage composition and spatial distance criteria as used for defining sites. The artifacts associated with each other are considered groupings. Additional criteria based on the number and type of artifacts was applied to distinguish groupings from clusters.

Both Getis Ord G_i^* and GIS buffering tools identified artifact clusters. Site-based survey identified a total of three sites. The Getis Ord G_i^* hot spot analysis identified four cluster boundaries at the 15 m scale. The buffering tool in ArcMap 10.2 identified six clusters using a 15 m buffer. Artifact clusters identified by the GIS analyses in the siteless survey are much (14 to 21 times) larger than sites identified by site-based survey. While artifact density was less within clusters, the artifact diversity within clusters is approximately two times greater than artifact diversity within the three sites.

According to Cannon (1983:791), “A simple determination of the number of artifact classes...can provide the best means for deriving behavioral inferences from material culture.” Carr (1984) argues that the identification of associated “sets” of archaeological material can help identify human activities in an area. The higher number

of artifact types within the siteless clusters may indicate a wider range of past behaviors associated with these clusters.

However, the small sample size of surveyed area, and the small sample of artifacts hinders an evaluation of whether siteless survey broadened the identification of assemblage diversity, and by implication, behavior diversity. The comparative survey and GIS analyses were successful in identifying artifact clustering not apparent within the site-based survey.

Tracy Lane Site-Based Survey with Sites and Isolated Finds

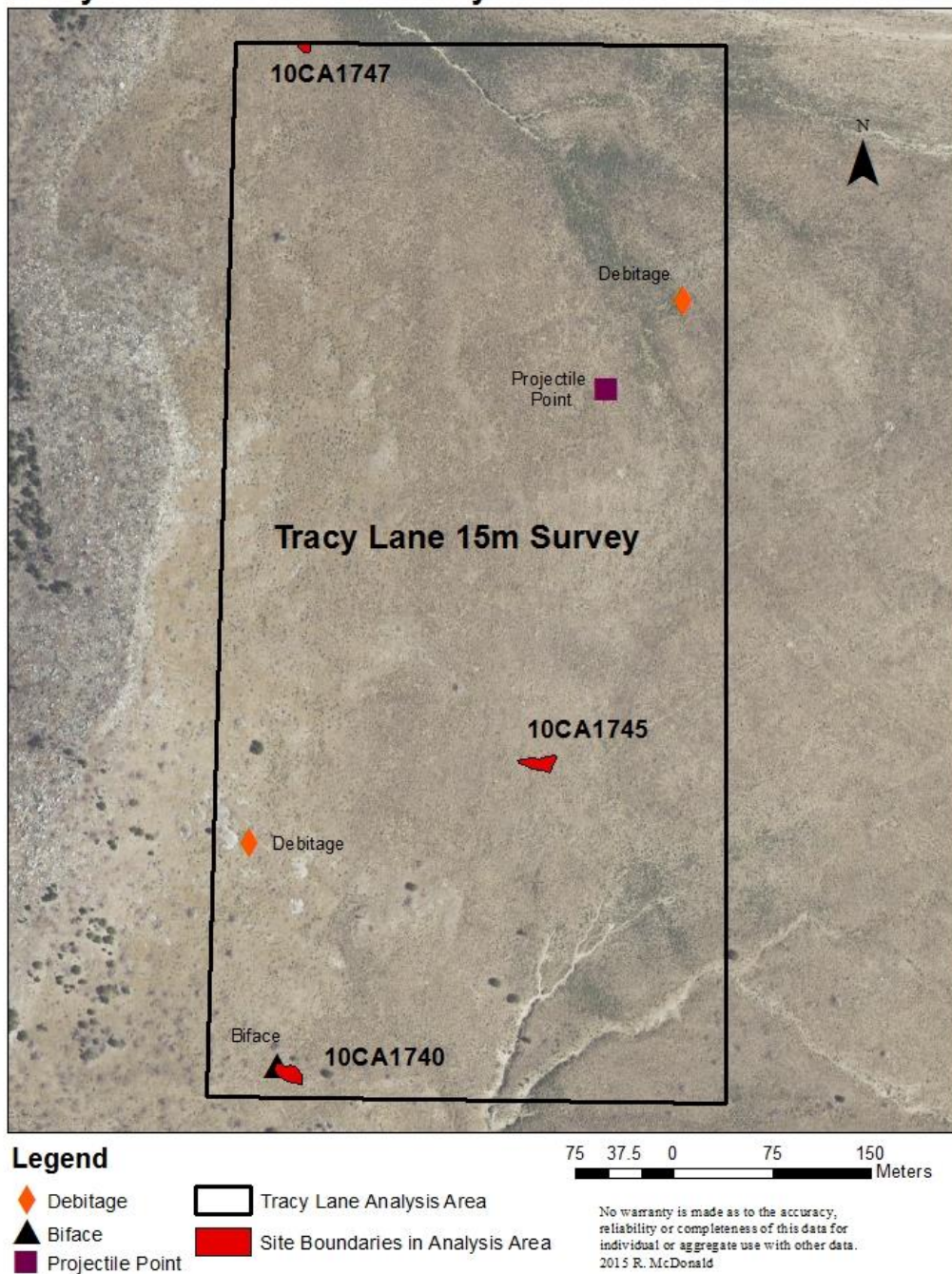


Figure 5. Topographic map showing the results of the site-based survey within the Tracy Lane Analysis Area.

CHAPTER V

CONCLUSIONS

“The archaeological record is a complex amalgam of patterning in material objects created by the organization of peoples’ activities in the past” (Ebert and Kohler 1988:101). This record undergoes subsequent cultural and natural formation processes adding to its complexity. Surface artifact assemblages are one expression of this record.

Archaeological survey is the primary method used to locate and evaluate archaeological materials for subsequent study. Survey methods vary in their scope, intensity, and documentation procedures. With rare exception, archaeological survey is used to identify and document archaeological phenomena within bounded spatial site units. The site thus becomes the primary unit of analysis.

The traditional site-based approach may not account for the breadth of cultural activities, such as mobility patterns or resource exploitation which took place on the landscape. Studies indicate, and the findings of this study concur, that siteless survey may identify more formal and diagnostic tools, and hence, activities on a landscape than traditional site-based survey recognizes. These activities would not be identified with a site-based approach because they are not contained within site boundaries. Siteless survey also reduces the inherent intrasite focus, instead directing attention to artifact patterning on a landscape scale (Dunnell and Dancey 1983; Ebert 1992; Foley 1980; Thomas 1973).

The siteless survey approach treats the landscape as “a single entity within which the nature and locations of physical artifacts and features must be assumed to be potentially related” (Ebert 1992:11). Cognizant of natural and cultural processes and their

potential effects on surface assemblages, researchers argue that surface artifact assemblages can hold greater value for understanding human landscape use than traditional site-based approaches (Ammerman 1985; Cowan 1987; Dunnell and Dancey 1983; Dunnell and Simek 1995, Ebert 1992; Odell and Riordan 1988). Some surface assemblages have been shown to have the ability to infer behavior in disturbed agricultural fields, erosional surfaces, and when artifact assemblages from single or short-term occupation are dispersed (Ammerman 1985, Dunnell and Simek 1995, Ebert 1992). “As long as surface distributions contain patterned information that is analytically separable from postdepositional patterning, they are useful data” (Dunnell and Dancey 1983:270).

Proponents of siteless survey frequently emphasize the importance of recording the location and attributes of each artifact on the landscape. By focusing analyses at the artifact level, spatial associations among clustered and non-clustered materials can be investigated (Burger 2004, Dunnell and Dancey 1983, Ebert 1992, Foley 1981, Isaac et al. 1981, Willey and Phillips 1953).

Proceeding from this foundation, this thesis compared the results of a siteless survey and a traditional site-based survey within a study area in southern Idaho. The primary objectives of this study were to

- (1) Compare the effectiveness of siteless and site-based survey to discover and locate artifacts within the same study or analysis area
- (2) Identify and analyze spatial patterning among artifacts.

The study area encompassed 80 acres within the City of Rocks Reserve in southern Idaho administered by the National Park Service. Site-based survey employed

15 m transect spacing; siteless survey used 5 m transect spacing. Site-based survey used an in-field process to identify sites and their spatial extent using specific criteria. Both site-based and siteless surveys employed GPS technology to collect spatial data. Site-based survey plotted the locations of lithic tools within sites and both tools and debitage in isolated find locations, a practice commonly used in many cultural resource management surveys.

Using GPS, siteless survey documented the locations of all located artifacts and then assigned them to an individual 5 x 5 m cell on a predefined grid. Siteless survey then used post-field GIS analyses to identify and characterize artifact clustering. Both site-based and siteless surveys collected identical data on artifact attributes. Different survey crews were used in each survey to reduce bias.

The siteless survey identified 28 percent more artifacts than the site-based survey. This result is consistent with the Wandsnider and Camilli's (1992) expectation that closer spaced transects result in the identification of a greater number of artifacts and is a key consideration in survey design.

This study also examined the effects of artifact obtrusiveness on the results of artifact detection. The expectation was that siteless survey (with its closer transect spacing) would result in greater detection of the less obtrusive chert artifacts. This expectation was not met. Chert artifacts comprise 18 percent of the total artifacts detected by siteless survey. Chert artifacts comprise 34 percent of the artifacts documented by the site-based survey.

An unexpected finding from this study is that the two survey methods resulted in a single coincidence of artifact detection within the surveyed area. A single ignimbrite

biface constitutes the only artifact found by both crews. Environmental conditions affecting artifact exposure, attentiveness of surveyors, or surveyor experience and ability may all be contributing. The data or analyses do not explain this finding. This finding is a reminder that alternate survey approaches are merely a sample of the archaeological record, and that no survey method can be expected to detect every artifact or feature.

Perhaps the most important finding of this study is that siteless survey field methods and subsequent GIS analyses successfully identified clustering and non-clustering of artifacts in a small survey area and with a small sample of artifacts. Using spatial data at the 5 x 5 m cell level GIS Getis Ord G_i^* examined patterns of clustering and found a single coincidence of clustering or artifact overlap with site boundaries located during site-based survey. The ArcMap 10.2 GIS buffering tool also identified clustering almost the same results as the Getis Ord G_i^* and the same overlap with the site-based survey approach.

The Getis Ord G_i^* Hot Spot analyses resulted in the identification of hot spots at every scale of analysis. The Getis Ord G_i^* optimized analysis identified the optimal peak in hot-spots at 44 m. Consequently, the approach of using geospatial cluster analysis may have validity for archaeological survey, even for site-based surveys, and in a way that preserves the positive features of site identification.

Most importantly, the GIS analyses allowed examination of spatial associations among the observed artifacts and their clustering at a wide range of spatial scales. As Ebert (1992:174) notes, the “recognition and definition of spatial clustering and the association of artifacts with one another...are wholly dependent upon the scales and resolutions at which patterns are observed.”

The methods and analyses used in this study build upon a body of archaeological inquiry regarding archaeological survey methods. Important methodological considerations in this study involved controlled transect spacing, plotting of individual artifacts and standardized artifact documentation procedures. Using controlled transect intervals ensures that the identified artifact clustering is not a measure of increased survey intensity. Standardized procedures for recording attributes of artifacts are essential for subsequent analyses within GIS. Plotting the spatial location of each artifact using GPS for assignment to a 5 x 5 m cell area was critical for subsequent GIS spatial analyses. In fact, the ability to plot artifacts with spatial provenience is a basic tenet of the Getis Ord G_i^* tool. In summary, these combined procedures were essential to both (a) the identification of artifact clusters and (b) subsequent analyses of these clusters and artifacts within clusters.

Despite the limited scope of the two surveys and a small sample of artifacts, siteless survey data and post-field GIS analyses demonstrated some potential for siteless survey, perhaps warranting further testing and evaluation.

Such testing could include conducting siteless and site-based survey in an area with a known sample of artifacts to evaluate the ability of each survey method to discover/detect artifacts. Additional testing could also include:

- (1) conducting siteless survey in areas with higher densities of known artifacts;
- (2) analyzing spatial patterning using data from previous surveys which have
 - (a) Plotted artifacts.
 - (b) Systematically collected attribute data.

Such study could provide for more robust testing of the Getis Ord G_i^* and the artifact buffering tools to identify spatial patterning of artifacts using larger artifact samples and in more varied cultural and natural environments.

Finally, the cost of archaeological survey will always be relevant to survey design. The cost of the site-based survey was approximately 32 man hours for the fieldwork within the analysis area. The siteless survey is estimated to have cost 56 man hours. The choice of survey design frequently involves decisions based on survey objectives, cost, and the data required to meet these objectives. It is within this context, that the potential of siteless survey to increase recovered data must be evaluated. Managers should, however, be aware of the potential of siteless survey in the archaeologist's toolkit.

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APPENDICES

APPENDIX A

SITE-BASED SURVEYS OF THE RESEARCH NATURAL AREA (RNA)
AND THE REGISTER ROCK PARCEL

These two site-based survey parcels were not chose for this research study but were surveyed under the same contract as the preferred Tracy Lane Area. Site-based survey of the RNA parcel resulted in the documentation of two archaeological sites and one IF. Site density for the RNA was calculated to be 2.15 sites per km². While surface visibility was good, rock outcrops, steep scree slopes, and cliff bands made linear survey extremely difficult in several areas. A significant portion of the RNA exceeded 30 percent slopes (Figure 3.5) The RNA was not considered viable and was excluded from further study due to the paucity of cultural discoveries identified during site-based survey.



Figure 3.4 Showing Research Natural Area Rock obstructions from 10CA1755.

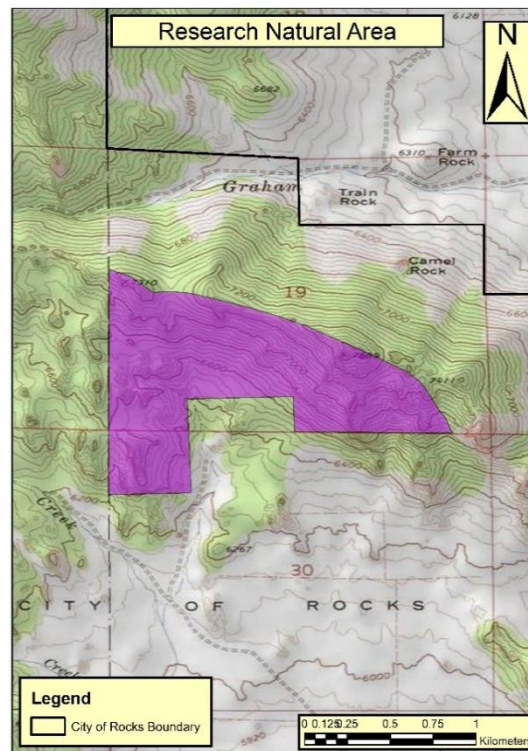


Figure 3.5. Topographic map showing the terrain of Research Natural Area.

Site-based survey of the Register Rock parcel resulted in the documentation of seven archaeological sites and three IFs. Site density in this parcel was calculated to be 5.88 per km². While the Register Rock parcel contained a high number of cultural materials within a survey area, varied vegetation created a ground cover that limited surface visibility, and it did not contain the highest site density per acre. In addition, rock outcrops, impeded or constrained linear survey.

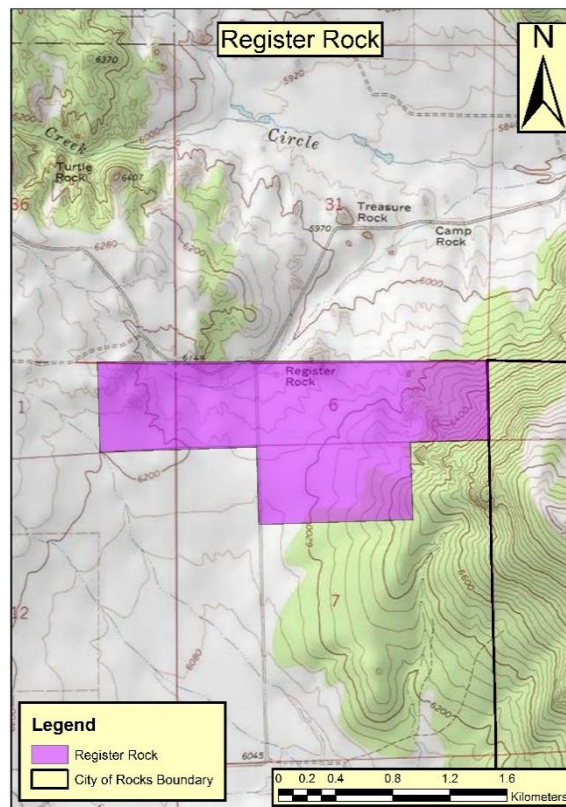


Figure 3.6. Topographic map showing the terrain of Register Rock.

