CHAPTER 1

INTRODUCTION

Archaeologists have traditionally studied evidence of trade and contact between sites by a comparison of artifact material and style, and on the distribution of these material goods through time and space (Renfrew and Bahn 1991), thus inferring contact through a theoretical network of trade or travel routes. Many current studies of obsidian and shell trade use chemical techniques to source the material, and obsidian hydration, or radiocarbon dating (for shell) to determine age. Old trails were also noted, studied, and accounted for in the past when the trails were still visible, well traveled, and well known (Colton 1941). Early in the study of American trade routes it was noted that shells were good markers of long distance trade routes in the southwest (Brand 1935).

Travel networks and trade routes can serve as important sources of data for archaeologists. Movement between geographic locations involved foot travel by Late Period inhabitants in the northern portion of San Diego County, in southern California. The network of footpaths created by pedestrian travel from region to region most likely remained consistent over time, so that the paths we see today while walking in these areas and what we see in aerial photographs were probably the travel networks used in the past. It is well documented that some of these footpaths became horse trails, then wagon paths, then rural roads, and then finally the modern highways of today. I intend to show that foot travel tends to follow the natural topography, which can be shown in modeled networks of travel paths. The method I use is experimental although not absent from the literature (see Chapter 2). The aim of this thesis is to model a network of least-cost paths (LCPs) in the study area to show how the natural topography affects the distance and direction of travel, and therefore the trade routes and potential contact routes for the Late Period inhabitants of the study area.

STUDY AREA

The location of interest for this study is Lost Valley, San Diego County, California. The prehistoric inhabitants of this area were, the Cupeño, a branch of the Uto-Aztecan

speaking people related linguistically to the Cahuilla to the north and east of their territory and the Luiseño to the west (Bright and Hill 1967; Hill and Nolasquez 1993). Culturally, the Cupeño also had contact and intermarried with the Ipai or Northern Kumeyaay, to the south, (APEC 1981; Bean and Smith 1978; Strong 1929). The territory of the Cupeño was exceptionally small, about 10 x 10 miles in size, encompassing the entire San Jose del Valle that lies to the north of the modern town of Warner Springs, and to the west and south of Lost Valley (APEC 1981; Bean and Smith 1978:588; Kroeber 1925:689). William Bright commented on the linguistic affinity of the Cahuilla and Cupeño when he concluded that "Cupeño is very close to Cahuilla, being perhaps an offshoot of it" while "Cahuilla, Cupeño, Luiseño, Serrano, and Gabrielino, with possible other extinct languages…form a genetic group which Kroeber [1907] called 'Southern California Shoshonean,'" or more conveniently "Takic" (Bright 1967:xxi). According to Victor Golla (2007:75), language differences between the Cahuilla, the Luiseno, and the Cupeño, were limited, indicating that movement of these peoples into the territory in which they were found at contact was "probably within the last millennium."

GIS Analysis

In order to analyze prehistoric footpaths, which represent the network of trade and contact, the use of Geographic Information Systems (GIS) was paramount. GIS are computer programs (the combination of computer hardware, software, and database management systems) that accept spatial input in combination with attribute data (contained in a database) that have the capability of analyzing those figures via logic and statistics, and the functionality to illustrate that material by way of map outputs, thus turning data into information. GIS have become part of the archaeologist's toolkit (Kvamme 2005; Moyes 2002).

A GIS application is relevant to this proposed study of prehistoric footpaths because one of its main uses is that of least-cost path analysis, that is usually applied to, for instance, a best route for the construction of a freeway, or hydrologic global functions such as those for watersheds, or drainage basins (DeMers 2002:81). Examples for the use of least-cost path analyses include modeled travel connections between mountain lion habitats (Gallo et al. n.d.), finding off-road routes for autonomous land vehicles (Stahl 2005), planning for

highway construction (Brumm et al. 2002), research on livestock trails (Ganskopp et al. 2000), research on urban landscape and trail making in the urban environment (Helbing et al. 1997), and an exploration of past regional landscape using cost surfaces (Howey 2007).

PREVIOUS RESEARCH THESES

Dr. Larry Leach, professor Emeritus, San Diego State University, conducted a field school in the study area of Lost Valley spanning the summer sessions between 1997 and 2003. The three research questions posed at the onset of the field schools were; (1) was Lost Valley occupied year round, rather than seasonally; (2) if occupation was seasonal, was it during summer and fall; and (3) if seasonally occupied, was it during the fall only to harvest seasonal foods available at that time of the year (Fleming 1999:4).

The harvest of the field schools has resulted in fodder for graduate students from San Diego State University, whom have produced several theses from the excavations, which are detailed in the next chapter.

PROBLEM AND SOLUTION

The use of GIS to study the system of travel networks is of interest to archaeologists, however studies of this problem seem to be somewhat limited. To extend the work done on Lost Valley prehistory described in the next chapter, I created a model of trail networks around Lost Valley within a pre-defined buffer zone (a specified distance around a feature) of Lost Valley. Since I was interested in how Lost Valley fits into the established trail network, I chose to use evenly distributed start and end points around the edges of a block of digital elevation models (DEMs), rather than use known site locations as the start and end points of the LCPs. The relationship of the modeled LCPs was then compared to known site locations in one small area of the total study area to note correlation between the model and the sites. The work done within the constraints of this thesis is an important contribution to the body of knowledge that has been produced through hands on involvement with the material excavated from Lost Valley. Future study of the excavated material can be compared to excavation or surface collected material from sites located along the network of least-cost paths. Possible travel networks equal possible social networks.

The DEM is an integral part of spatial analysis, and also becomes a major part of the visual presentation, as site locations and the networks between them can be visualized in

relation to terrain. A DEM is "a sampled grid or raster-based representation of continuous topographic surfaces on portions of the globe" (DeMers 2002:83).

The following research questions are posed in order to lay a foundation for the regional spatial analysis of Lost Valley sites to gain insight into how they are connected to the surrounding area:

1. How is Lost Valley linearly connected to areas to the west and east, within portions of the San Luis Rey and Anza Borrego watersheds?
2. Is Lost Valley situated on a travel network from the Borrego Springs area following a least-cost path to sites west of Lost Valley?
3. How does the natural topography of the watershed function in defining travel or trade networks?
4. Is there a relationship between the modeled paths and the archaeological sites that have been documented and recorded?

LIMITATIONS AND CONSTRAINTS

Least-cost path analysis will delineate the most likely routes through Lost Valley from the west (through parts of the San Luis Rey Watershed) and the east (northern Anza-Borrego Watershed).

The focus of this thesis changed dramatically over time, from visualization of artifactual remains at the site level, to regional study of Lost Valley, to situating Lost Valley as part of a much larger region, and finally to trade and trails and modeling least-cost paths through or near the Lost Valley area to demonstrate how Lost Valley is connected with the surrounding area/territories via virtual trade routes or travel networks. There are several intertwining data sets with which to negotiate. First, the ethnographies of the prehistoric and protohistoric inhabitants of Cupeño territory and the surrounding tribes/groups/territories as described by Kroeber (1925) and Bean and Smith (1978); second, Native American trail systems and known trade networks from the literature; third, GIS in general and the use of GIS in archaeology, specifically the use of least-cost path in research; and fourth, theory and method that combines the use of GIS and archaeology.

SUMMARY OF CHAPTERS AND APPENDICES

The next chapter of the thesis will discuss the background of the project, including what is known about the people who once occupied Lost Valley (the Cupeño), and the natural history of Lost Valley. Following the background section, the literature review

(Chapter 3) provides an explanation of the uses of GIS in archaeology, especially least-cost path analysis. A section on the methods (Chapter 4) to be used in the study follows the literature review. This leads to the results and discussion section (Chapter 5) providing the results of the procedures described in the methods section and discussion of the meaning of the findings. Finally, Chapter 6 brings the thesis to a close with the addition of possible future research projects that evolved through this research. The Appendix includes summaries of the four initial projects that were completed in the beginning stages of research. These four projects are included because this project is the result of the evolution of ideas that led to the end product of this thesis.