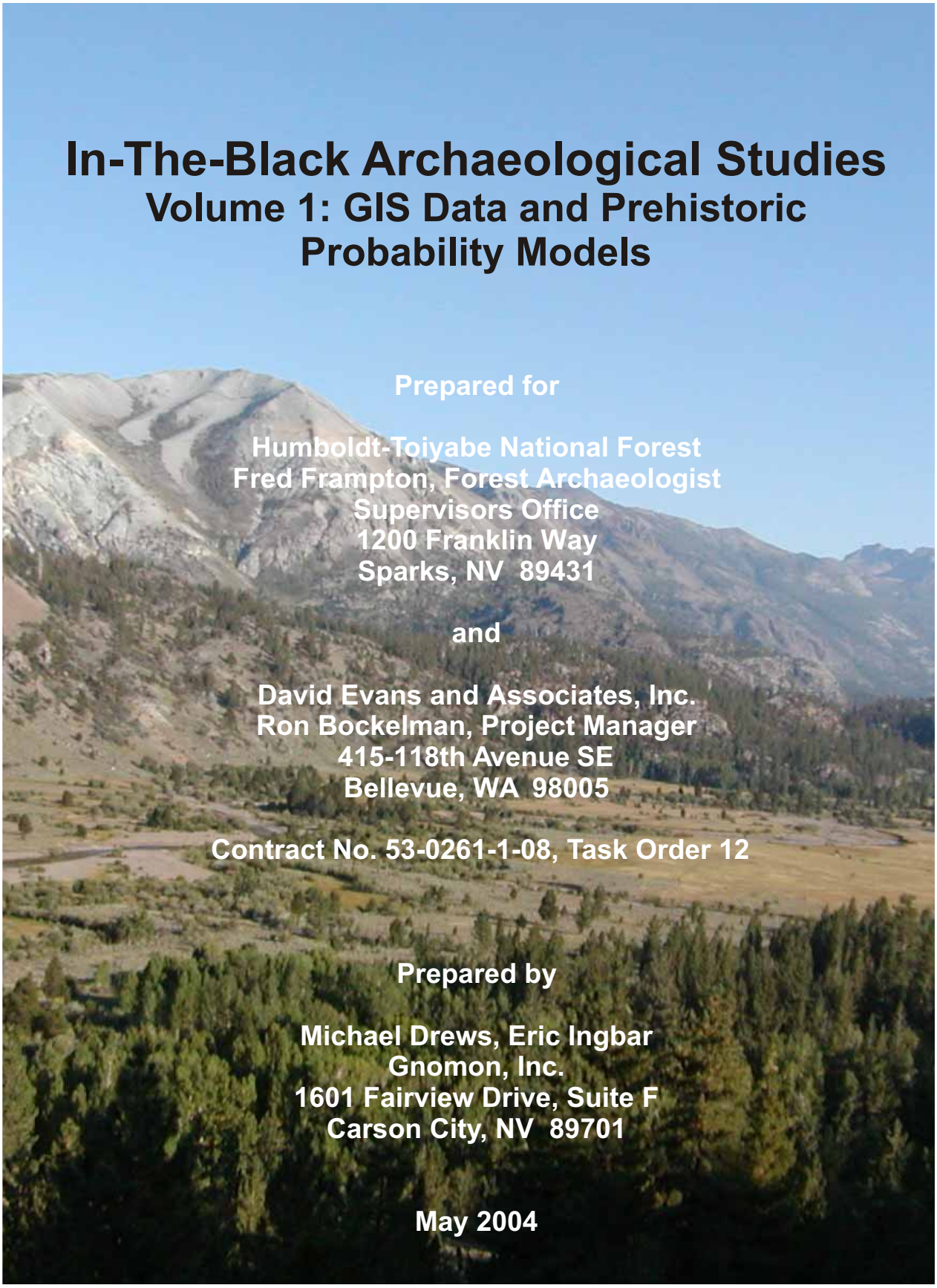

In-The-Black Archaeological Studies
Volume 1: GIS Data and Prehistoric Probability Models

Prepared for

Humboldt-Toiyabe National Forest
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Contract No. 53-0261-1-08, Task Order 12

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Cover photo:
Leavitt Meadows, Humboldt-Toiyabe National Forest, Bridgeport Ranger District

In-The-Black Project Overview

In recent years wildfires have increasingly been a major consideration in managing archaeological and historic resources on National Forest System (NFS) lands administered by the Humboldt-Toiyabe National Forest (HTNF). Wildfires may directly impact these resources by destroying them. Impacts may also occur during fire suppression activities. Archaeological and historic sites also must be protected from potential adverse effects of wildfire prevention and protection activities.

The efficiency of managing of historic properties on NFS lands can be improved by having landscape-wide electronic capabilities. HTNF decided to develop three tools for managing heritage resources as part of a comprehensive project that became known as In-The-Black:

- Digital tool for managing information about historic and prehistoric archaeology and areas of prior inventory (GIS with database),
- Bibliography providing information about historic uses and serving as an information source on the recent past, and
- Planning (probability) sensitivity model to forecast areas where heritage resources are likely to be found.

David Evans and Associates, Inc. (DEA), as a prime contractor providing natural and cultural resources support to HTNF and other national forests in the Intermountain Region, assembled a project team to develop these tools for four study areas. Roles and responsibilities were:

- Gnomon, Inc. developed the GIS, databases, and predictive models for all four areas;
- Summit Envirosolutions, Inc. compiled historic bibliographies and conducted limited field inventory to test the predictive models for the Carson Range / Peavine Mountain and West Walker Watershed study areas (Carson and Bridgeport ranger districts, respectively);
- Northwest Archaeological Associates, Inc. (NWAA) compiled historic bibliographies for the O'Neil Basin and Martin Fire study areas (Jarbidge and Santa Rosa ranger districts, respectively), and conducted limited field inventory to test the predictive model for the O'Neil Basin area.

The DEA team worked collaboratively with HTNF archaeologists to produce a 5-volume report on the *In-The-Black Archaeological Studies*:

Volume 1: GIS Data and Prehistoric Predictive Models (prepared by Gnonom),

Volume 2: Carson Range / Peavine Mountain Study Area Report, Carson Ranger District (prepared by Summit),

Volume 3: West Walker Watershed Study Area Report, Bridgeport Ranger District (prepared by Summit),

Volume 4: O'Neil Basin Study Area Report, Jarbidge Ranger District (prepared by NWAA), and

Volume 5: Martin Fire Study Area Report, Santa Rosa Ranger District (prepared by NWAA).

A comprehensive archaeological GIS, database, and prehistoric predictive model for the entire Bridgeport Ranger District has been developed as a separate project by Gnomon and DEA. It incorporates West Walker study area information from the In-The-Black project.

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ACKNOWLEDGEMENTS

Numerous people made the work reported here possible and facilitated its timely completion. Fred Frampton in the Humboldt-Toiyabe National Forest Supervisor's Office conceived the project and consistently offered his support and direction. Archaeologists Terry Birk, Jack Scott and Karen Kumeiga graciously allowed access to their files as well as their expert opinion and enthusiasm for the project. The staff at each of the Ranger Districts: Carson City, Bridgeport and Elko, were a pleasure to work with. We discovered that with so many seasonal hires, unfamiliar faces are immediately accepted at District offices. Our only concern was in exchange for that hospitality we'd be asked to go fight fire. The Gnomon, Inc. personnel whose names do not appear on the report cover are the reason this project is possible at all. Countless hours of data automation, verification, and analysis were done by; Reese Tietje, Rori Vogler, Jeff Secord, Darlene Cobbey, and Gene Griego. Eric Ingbar was always available to offer advice on model creation and interpretation of results. Jennifer Mauldin's graphic eye and word processor wizardry somehow managed to make our manuscripts look good, despite us. As always, it was a pleasure to work with our colleagues at Summit Envirosolutions, Inc. and Northwest Archaeological Associates, Inc. Finally, Ron Bockelman of David Evans and Associates facilitated communication between all parties and kept the project on task. Our thanks and gratitude to all.

I. INTRODUCTION

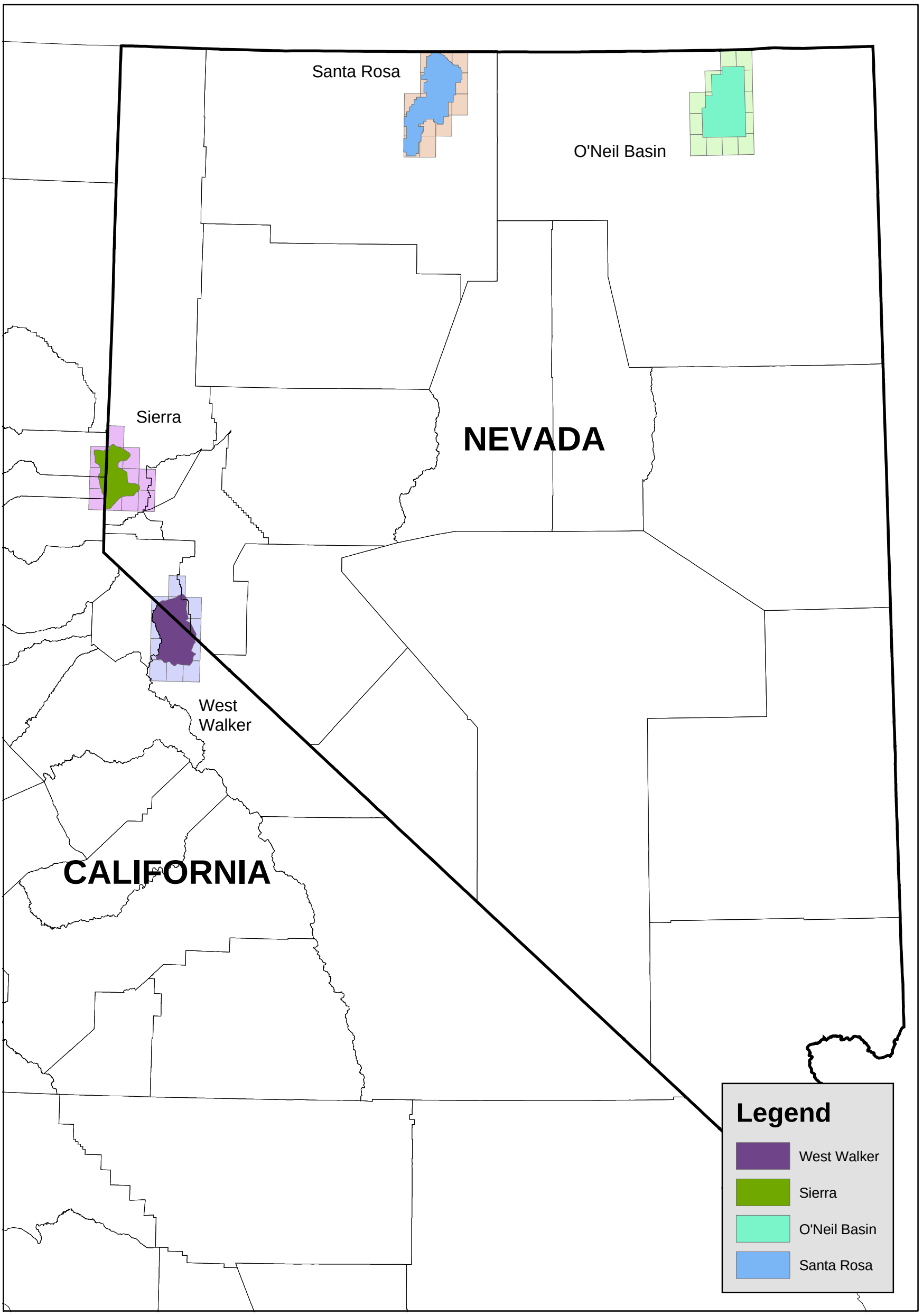
Recent wildfires in several administrative units of the Humboldt-Toiyabe National Forest have consumed large acreages and have brought to the forefront the need to more efficiently manage heritage resources within the forest. The purpose of the In The Black Cultural Resources Probability Model is to develop a spatial model that uses available environmental layers to forecast the location of cultural resources. The model provides forest managers with a tool that assesses cultural resource sensitivity allowing better estimation of related costs. The model also outlines a process for subsequent testing and facilitate updates to the database and model as needed.

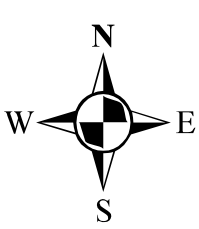
Within the last 10 years, cultural resource sensitivity models developed within the Great Basin (Zeanah 1995, 1999; Drews et al. 2001) produced satisfactory forecasting results. These models use a deductive anthropological framework based on optimal foraging theory. Deductive models rely upon fine-grained environmental information and are thus both costly to create and limited in areal extent. Inductive models, which seek correlations between cultural resources and other factors are an alternative complementary approach. Broader, more intuitive modeling has recently been compiled for a large portion of the eastern Great Basin (Drews et al. 2004). It originates from a statistical analysis of site location against relatively coarse landscape datasets.

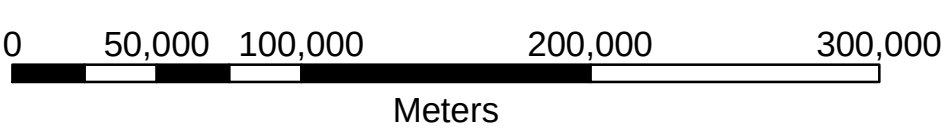
The In The Black probability model is an intuitive model. It identifies statistically-based spatial relationships between prehistoric sites and readily discernable environmental attributes. Those relationships combine to create a sensitivity or likelihood framework. The model is not an explanatory anthropological model. It is to be used as a management tool that identifies areas where the likelihood of encountering prehistoric cultural resources may increase costs associated with a proposed activity.

The project area is widely dispersed across the northern Nevada landscape, and extends into portions of eastern California. Portions of four Humboldt-Toiyabe National Forest Ranger Districts are included within the project area (Figure 1.1). The Sierra study area

Project Area Location Map







lies within the northern portion of the Carson Ranger District roughly between Peavine Mountain and Mount Rose. To the south, the West Walker study area lies between Topaz Lake and Bridgeport, California, within the northern part of the Bridgeport Ranger District. The extreme eastern portion of the Jarbidge Ranger District comprises the O'Neil Basin study unit. It is located in north central Elko County, east of the Jarbidge Mountain crest. The Santa Rosa study area includes the entire extent of the Santa Rosa Ranger District in northeastern Humboldt County. Limited testing of the model by field survey was conducted for the Sierra, West Walker and O'Neil Basin study area. The Santa Rosa Study Area received no field testing.

II. METHODS AND PROCEDURES

Predictive cultural resource models are "a simplified set of testable hypotheses, based either on behavioral assumptions or on empirical correlations, which at a minimum attempts to predict the loci of past human activities resulting in the deposition of artifacts or alteration of the landscape" (Kohler 1988:33). Based upon their accumulated experience, most archaeologists could, on cursory review of a topographic map, accurately predict with 50% to 80% accuracy where archaeological sites would most likely occur. Predictive capacity alone, however, fails to meet the explanatory capacity of scientific inquiry. Predicting where sites occur does not explain why they occur where they do. Also, sites that fall outside of the predictive pattern are often of greater interest to archaeologists (Heidelberg (2001:6).

A number of approaches have been employed as a means to identify patterns within probability layers: *inductive, deductive, intersecting*, and *weighted.* An *inductive* approach establishes conclusions based upon recognition of statistical patterns within overlapping datasets. The approach is widely used because it draws upon readily available accumulated survey information. Biases are inherent due to variable inventory strategies, sampling criteria and vagaries in data collection methods. Indeed, the extent and methods employed for most archaeological inventory are driven by regulatory compliance issues rather than by scientific inquiry. Sampling is biased by land use needs rather than by theoretical stratification. Nonetheless, a substantial reduction in model costs are realized from use of existing regulatory data.

Deductive patterns are derived from data specifically collected for the purpose of the study. Pertinent datasets are based on theoretical models that are explanatory in nature. For example, if we assume that campsites will be located within the proximity of any number of environmental or resource locations, we can identify those areas spatially then test our assumptions within a research framework. Sampling strategies are controlled so that data collected from specific settings within the model environment are consistent. This consistency allows for negative findings to be more readily assessed. Additional

background layers consisting of regionally specific data on vegetation, elevation, slope, aspect, soils, hydrology, and climate can be used to test deductive hypotheses.

An *intersecting* approach combines deductive or inductive datasets with background layers to define probability within each environmental layer. When several probability zones overlap, their intersection defines an area of high sensitivity, with fewer overlaps defining medium and lower sensitivity zones.

A significant problem with the *intersecting* approach is that all variables are considered equally. To counter that shortcoming, environmental variables can be *weighted* so that positive or negative relationships within a layer can be assigned relative values based upon expert opinion or inductive/deductive approaches. For example, aspect, might be assigned a lower relative value than say distance to water. A scalar variable may also distinguish relative values within each environmental class. A combination of *intersecting* and *weighting* methods creates an even more robust approach.

Selecting environmental and cultural attributes, converting them systematically to variables, then determining how those variables would be analyzed was a major consideration for the development of the planning model. Fine grained environmental datasets contain a wealth of information but require very specific manipulation to return a desired analytical layer. Results are hard to duplicate and modeling based upon those datasets are difficult to maintain without considerable technical expertise. Finely defined variables are also more difficult to observe or quantify during field testing.

For the analysis presented here, a simplified framework was sought; one that incorporates easily observable environmental and cultural resource layers with a straightforward and maintainable modeling process. Four layers were considered as environmental variables: elevation, slope, distance to water, and vegetation. The layers are drawn from readily available sources and are easily duplicated. Cultural resource and inventory layers were collected from various archival sources and added to the dataset. Datasets and the modeling process are described in the following section.

Environmental Layers

Landscape level analysis required the compilation of a number of environmental data sets or evidential themes that could be used with the site data to construct a probability model. Datasets compiled for the project area included slope, vegetation, landform, and hydrology.

Elevation and Slope

Elevation and slope were derived from a combination of the USGS National Elevation Dataset (NED) and 10 meter digital elevational models (DEM) compiled by the United States Geological Survey and provided to us by the Humboldt-Toiyabe National Forest. Slope and elevation were calculated for each cell, and then converted to elevation or slope grids. Elevation grids were grouped into 500 meter bands. For analytical purposes, slope was divided into five classes: 0-5 degrees, 5-11 degrees, and greater than 11 degrees. Again elevation and slope were used to evaluate inventory coverage and site distribution. NED were also used to create shaded relief maps for use as background graphics in each of the analytic units. Metadata for NED conforms to National Standards for Geospatial Metadata.

Vegetation

Vegetation layers, derived from the USGS Gap Analysis Program (GAP), were provided by the Humboldt-Toiyabe National Forest. Land cover maps of GAP data are produced from 30 meter, digital satellite imagery, and depict dominant vegetation types. Since GAP data is compiled on a small scale, vegetation extent is somewhat generalized and oriented toward regional rather than local vegetation regimes. For Nevada, the Biologic Resources Research Center at the University of Nevada, Reno provides GAP data and metadata.

Distance to Water

A hydrologic layer consisting of springs and streams was compiled for each of the analytic units. Source data was derived from *USGS 1:100,000 National Hydrography Dataset (NHD)* clipped to the project area then buffered at 500 meter intervals. Buffered shapes were then converted into grids for each analytic unit. Both intermittent and perennial stream classes are included in the dataset, since water features currently identified as intermittent may have been more productive prehistorically. Metadata for the NHD data can be accessed at the USGS National Hydrography Dataset website.

Cultural Resources and Inventories

Cultural resource layers compiled for the analysis were derived from a number of different sources. Varying amounts of manipulation were needed to make them useful. The goal was to assemble a comprehensive set of spatial and database records for sites and inventories. These are used in modeling and will be useful for management. Nevada is implementing the Nevada Cultural Resources Information System (NVCRIS), an information system for cultural resources that consists of spatial data and database records for sites and inventories. Most of the NVCRIS data was compiled from records at the Nevada State Museum. The majority of data for the Nevada study areas was derived from NVCRIS.

The Humboldt-Toiyabe National Forest maintains a relatively complete site database, compatible with NVCRIS, along with 7.5 minute map plots of cultural resources and inventories on Forest Service lands. In addition, Information Centers maintain site files, reports and map plots for counties within California. Those information centers (Northeast Information Center; California State University, Chico, North Central Information Center; California State University, Sacramento, Eastern Information Center; University of California, Riverside) were consulted to acquire data for portions of the study areas lying within California.

Depending upon relative size of the feature, site and inventory locations were digitized as point, line or polygon shapes. Generally, any sites or inventories less than 2.5 acres in area were plotted as a points, linear inventories and linear sites were plotted as lines, and larger polygonal inventories and sites were digitized to their full extent. For analytical purposes, points and lines were buffered to create polygons then merged with the appropriate (site or inventory) polygon layers to create single polygonal site or inventory layers. Per contract requirements, all shapefiles were converted to *ArcInfo*® regions. All GIS datasets were converted from their default projections to UTM Zone 11, NAD 1927 projection. In most cases, rather than confine cultural resource data to the more restrictive project boundaries, the archive search was expanded to include entire quadrangles touched by the project extent.

NVCRIS site and inventory databases and the Humboldt-Toiyabe National Forest site database are compiled in a *Microsoft Access*® format with similar fields. The site database integrates IMACS (Intermountain Antiquities Computer System) coded data into a comprehensive functioning database. Forest Service and NVCRIS datasets were joined into a single file. Data from archival sources, not present in the combined database, was added as necessary. Site records link to the GIS site attribute tables on a common field, usually site number.

The inventory database, also in *Microsoft Access*® contains bibliographic and management data, consisting of report title, associated numeric identifiers, submittal date and survey type at a minimum. To provide comprehensive inventory data for the project area, title page, management summaries, methods and results sections of any inventory report not already in the NVCRIS database were copied from Forest Service or Information Center archives and added to the existing base file.

Sierra Study Area, Carson Ranger District

Most cultural resource shapefiles for sites and inventories, as well as associated databases for the Nevada portion of the Sierra Study Area were populated with data from NVCRIS

(Figure 2.1). The model area comprises 12 quadrangles, the westernmost three quadrangles cover portions of Placer, Nevada, and Sierra counties in California. Information from existing electronic sources was compared to data maintained on map plots at the Humboldt-Toiyabe National Forest, Carson Ranger District Office in Carson City. Any additional sites or projects found were added to the model area database. Archival data for the project area extent within California were gathered from the North Central Information Center, CSU Sacramento for quads within Nevada and Placer Counties and the Northeast Information Center, CSU Chico for Sierra County Quads.

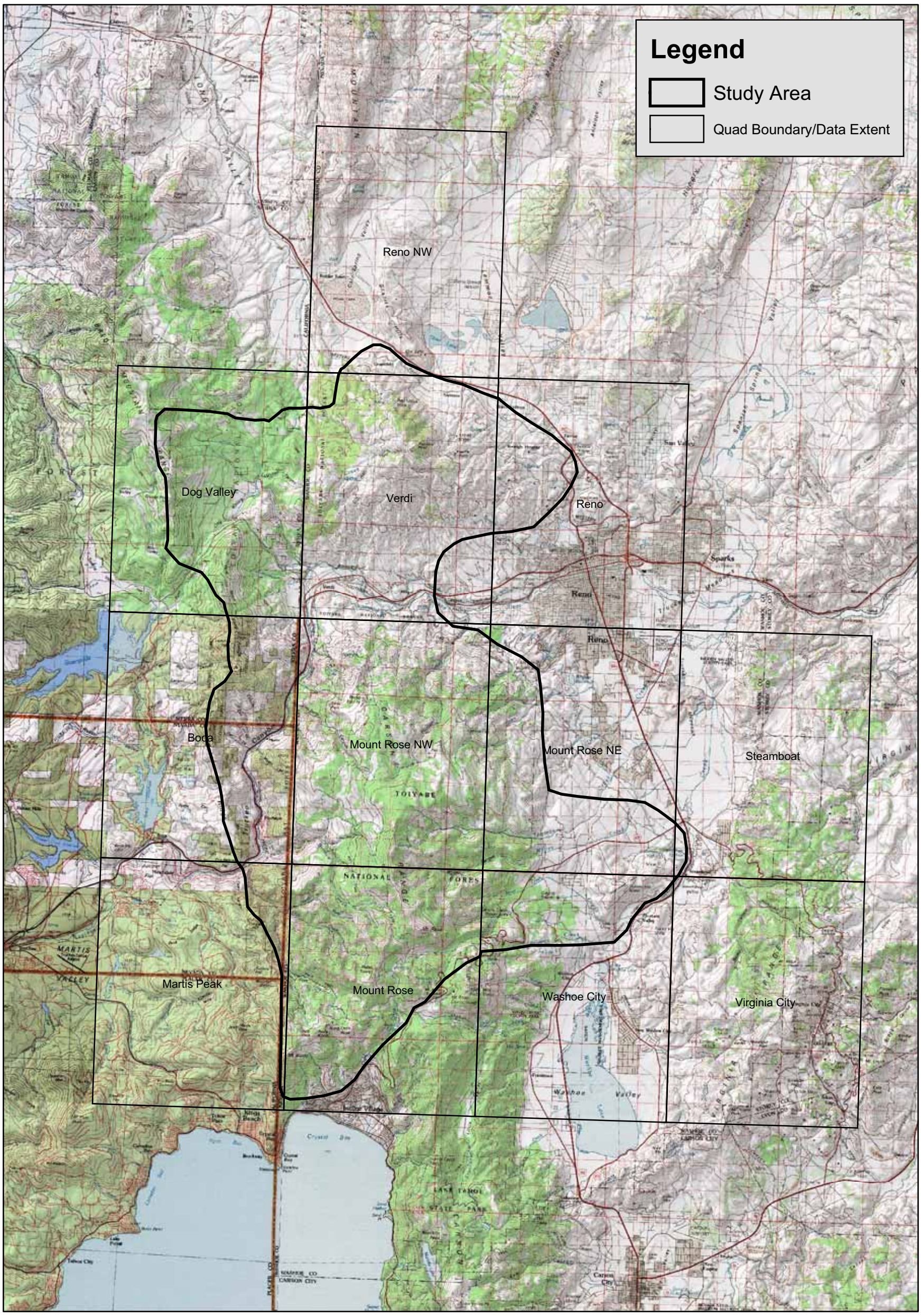
Walker Study Area, Bridgeport Ranger District

The Walker Study Area encompasses 13 quadrangles lying south of Topaz Lake and north of Bridgeport, California. Two quadrangles lie wholly within Nevada, six within California, and five straddle the state line (Figure 2.2). NVCRIS data was used to compare site and report data archived at the Humboldt-Toiyabe National Forest, Bridgeport Ranger District office, and in a manner similar to the Sierra Study Area, missing data was gathered and integrated into the model database. Forest Service data pertaining to portions of the study are lying within California were also gathered at that time. The updated dataset was then used for comparison with archival data maintained at the Eastern Information Center at Riverside, California and any missing data was added.

O'Neil Basin Study Area, Jarbidge Ranger District
Santa Rosa Study Area, Santa Rosa Ranger District

Both the O'Neil Basin Study Area and the Santa Rosa Study Area lie wholly within Nevada. Cultural resource information for this portion of the project area was derived from the NVCRIS dataset. Additional archival information was gathered from the Humboldt-Toiyabe National Forest office in Elko, Nevada. Missing files were integrated into the larger NVCRIS dataset. Figures 2.3 and Figure 2.4 depict the broad area from which the cultural resources dataset was populated.

Sierra Study Area
Quad Boundary and Data Extent

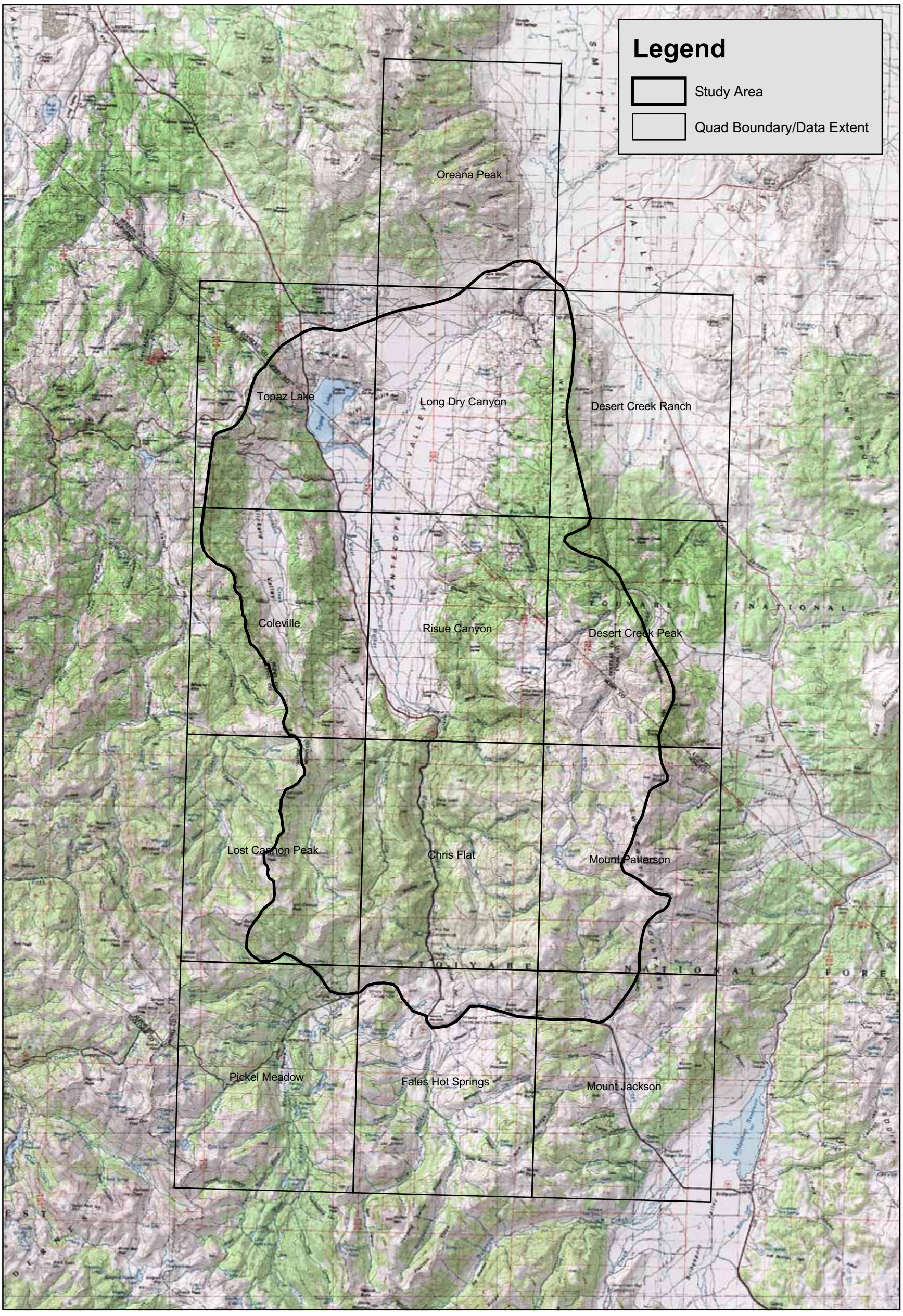


N
W E
S

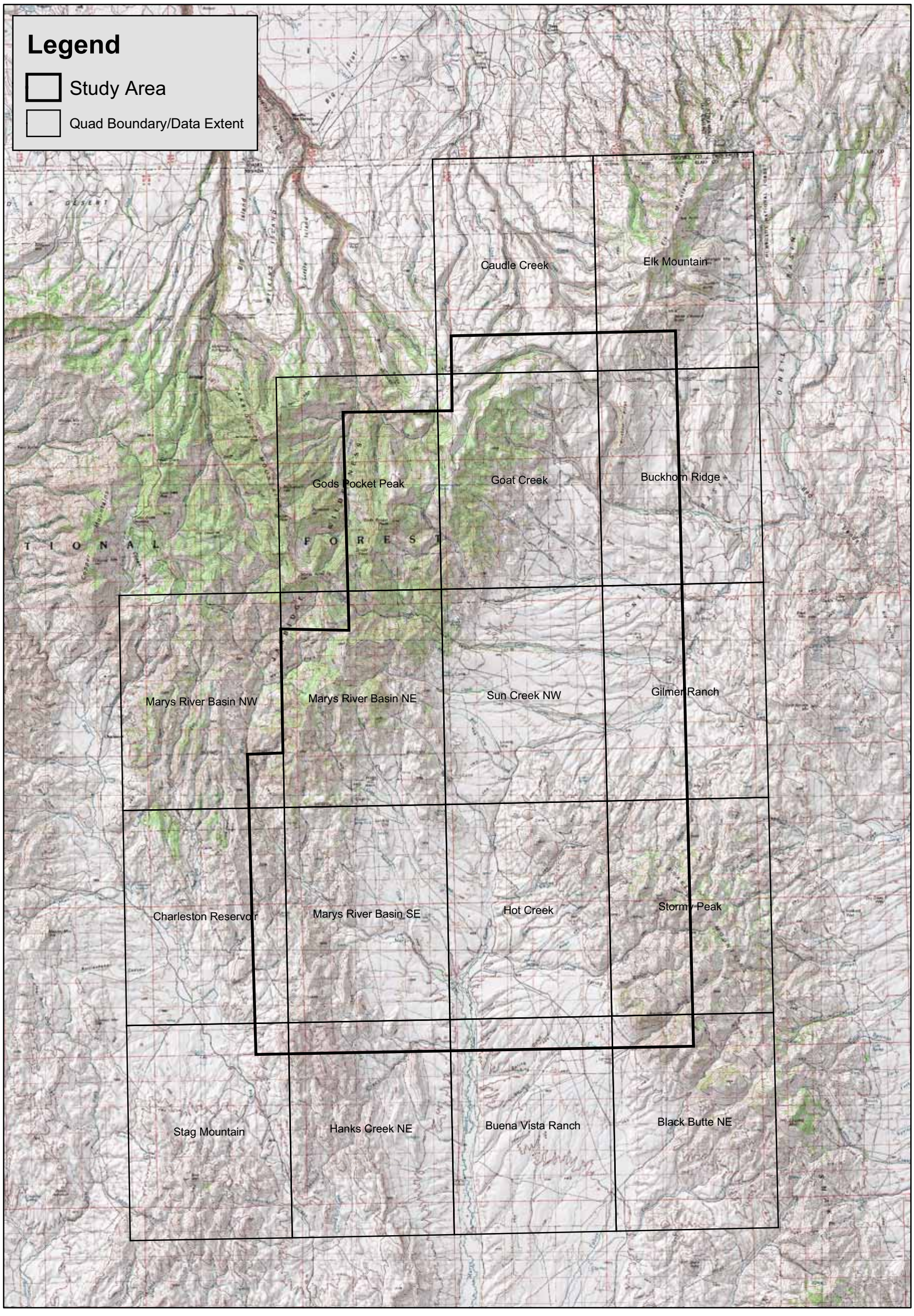
0 5,000 10,000 15,000 20,000
Meters

Gnomon, Inc.

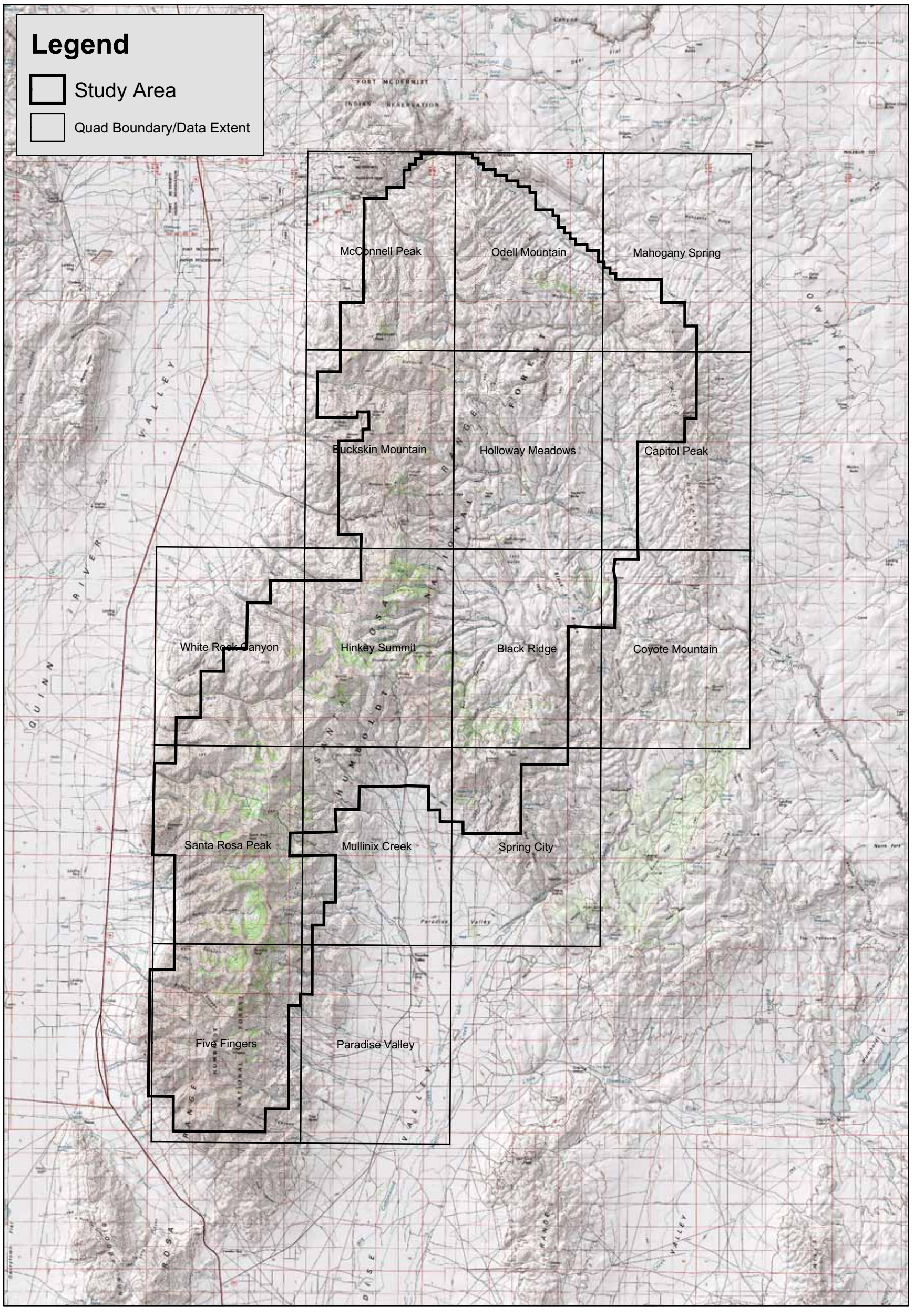
West Walker Study Area
Quad Boundary and Data Extent



O'Neil Basin Study Area
Quad Boundary and Data Extent



Santa Rosa Study Area
Quad Boundary and Data Extent



Hard copy ledgers and electronic datasets of Humboldt-Toiyabe National Forest cultural resources were collected from respective district offices and the Humboldt-Toiyabe National Forest Supervisor's office in Sparks, Nevada. Completeness of the data varies between offices, but was useful, especially for resolving site number/project concordance and other administrative matters relating to sites and investigations.

Site data from records predating IMACS (1982) proved to be somewhat inconsistent. Likewise, early investigations are generally less complete than more recent ones and survey methods used at the time varied considerably.

Analytic Methods

The comprehensive archaeological datasets allowed multiple modeling attempts. Initial analysis consisted of evaluating inventory areas for sampling adequacy within stratum of each layer. Environmental and cultural resource layers were gridded into 10 by 10 meter grids then analyzed using *IDRISI*®, a raster based GIS imaging and image processing system. Resulting cross tabulations produced tables that related frequency of inventory within each zone. Areas with little or no inventory were excluded from consideration as being predictive and were identified as areas of high priority for field testing. Table 2.1 shows an assessment of inventory against elevation classes in the Sierra Study Area. It is important to note that while the inventoried areas above 3000 meters represents .3% of the total study, it accounts for over one-third of the total area within that class.

The first run of the cultural resources model considered all sites within the model area contrasted against environmental layers. In a normal distribution one would expect site density to conform generally to areal density within each class. An environmental zone comprising 50% of a layer should contain roughly 50% of the overall site area. Based upon summary comparison of site area to study area, zones with proportionally greater ratios were considered to be of higher sensitivity (Table 2.2). As higher than expected areas were identified within each environmental layer, they were weighted so that they could be combined and evaluated for composite modeling.

Table 2.1 Inventoried Area Against Elevation for the Sierra Study Area

Inventory Against Elevation (500m intervals, 10 meter cells)

	1000-1500 m.	1500-2000 m.	2000-2500 m.	2500-3000 m.	3000+ m.	Total
No Inventory	95303	2598099	1834727	909428	41252	5478809
Inventory	139993	658134	222119	238715	20995	1279956
Total Area	235296	3256233	2056846	1148143	62247	6758765
Area %	3.48%	48.18%	30.43%	16.99%	0.92%	100.00%
Inventory %	10.94%	51.42%	17.35%	18.65%	1.64%	100.00%
% Total Area Inventoried	2.07%	9.74%	3.29%	3.53%	0.31%	18.94%

Table 2.2 Table Depicting Inventory Area and Site Proportions

Slope in Degrees

	0-5 degrees	5-11 degrees	11+ degrees	Total
No Inventory	550152	1195892	3732765	5478809
Inventory	291017	296737	692202	1279956
Total Area	841169	1492629	4424967	6758765
Area %	**12.45%**	22.08%	65.47%	100.00%
Inventory%	22.74%	23.18%	54.08%	100.00%
%Total Area Inventoried	4.31%	4.39%	10.24%	18.94%
Sites	80039	50543	24520	155102
Site%	**51.60%**	32.59%	15.81%	100.00%
Inventoried Areas				
No Sites	787227	1460991	4411844	6660062
Sites	53942	31638	13123	98703
Site%	**54.65%**	32.05%	13.30%	100.00%
Weight		**1**	0	0

The proposed model is a composite of sensitivity within each environmental layer. For example, if areas with low slope, near water, and in sagebrush are determined to be sensitive within their distinct environmental zone, composite sensitivity would be highest for cells meeting all three criteria, moderate if only a single criterion were met, and low if no sensitivity masks were present.

Using sites found by systematic inventory and outside of systematic inventories is problematic. Including sites not found by inventory creates uncontrolled bias in sampling. This makes non-parametric testing difficult. One knows where sites have been reported, but absence of sites is not reliably quantified. To better assess site distribution, data was re-analyzed using only sites from inventoried areas. This allowed presence or absence of sites and chi square tests run to be used to assess distributional hypotheses.

For each significant environmental layer, cross tabulations were run for site grids within the inventoried space. Results are presented in summary tables for each environmental zone (Table 2.2). Site and non-site cells, were counted within inventoried areas. The results were tallied within 100 meter cells, then imported into a spreadsheet where chi square values and residuals were computed. If chi square results identified that sites within specific environmental layers were not drawn from a normally distributed population, chi values and adjusted standard residuals were examined to determine which of the environmental zones affected the overall distribution (Table 2.3). That factor is considered to be the most predictive factor within a given environmental layer. Factors were summed to make a composite sensitivity forecast.

Summary sensitivity forecasts were compiled for each study area into create a three-tiered hierarchy ranging from high to medium to low. Since the numbers of probability classes vary by study area, composite sensitivity scores are evaluated and grouped separately by study area. For each area, a composite sensitivity map was then compiled (Figure 2.5) and a spatial intersect of sensitivity and site area was calculated to assess the model's goodness of fit.

Table 2.3 Chi Square Calculated for Slope Within the Sierra Study Area

Cells on a 100 m Grid

	Site	Not Site	ROW
0-5	539	2371	2910
5-11	316	2651	2967
11+	131	6791	5877
COL	986	11813	12799

Expected Values

	Site	Not Site
0-5	224.18	2685.82
5-11	228.57	2738.43
11+	452.75	5424.25

Cell Chi Values

	Site	Not Site
0-5	314.82	-314.82
5-11	87.43	-87.43
11+	-321.75	1366.75

Chi-Squares

	Site	Not Site	
0-5	442.11	36.90	
5-11	33.44	2.79	
11+	228.65	344.38	
	Chi-Square For Table		1088.28

Cell Standard Residual

	Site	Not Site
0-5	21.03	-6.07
5-11	5.78	-1.67
11+	-15.12	18.56

Cell Variance

	Site	Not Site
0-5	0.71	0.06
5-11	0.71	0.06
11+	0.50	0.04

Adjusted Standard Residuals

	Site	Not Site	
0-5	24.90	-24.90	
5-11	6.87	-6.87	
11+	-21.40	90.92	
	Sum		69.51

Study Area Sites and Inventories
within Sensitivity Zones

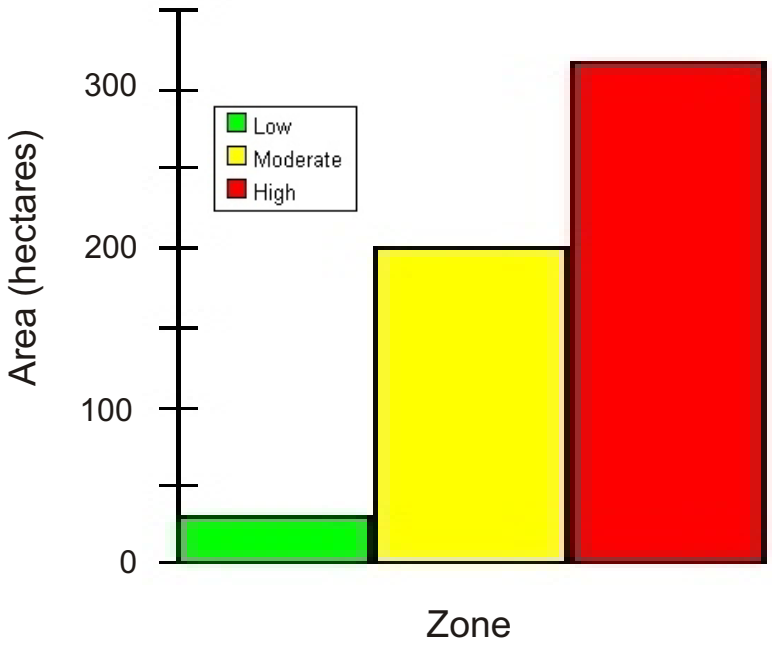
Redacted - Contains Sensitive Information

If the model is working correctly, then the highest sensitivity zones should contain proportionally higher densities of site area than those with lower sensitivity. Analysis of inventories against sensitivity area serves to support model results especially when minimal survey area correlates with maximum site density (Figure 2.6).

Model Testing

To define areas for subsequent testing, model cells were clipped to include only Forest Service lands. Any area within a kilometer of previous inventory was eliminated from the sample, and when discernable, the remaining grids were stratified by environmental characteristics. Sampling extent for the entire project area was defined within the project scope and to maximize field productivity sample units were generally restricted to those adjacent to reliable access roads. In all cases, sample transects occurred within selected 500 meter square or congruent cells falling within each of the three (high, moderate, low) sensitivity zones. Survey methods followed Humboldt-Toiyabe National Forest Guidelines. Survey results are reported in separate sections of this report.

All Sites
within Santa Rosa Study Area



Hectares	Acres	Zone
30	74	Low
200	494	Moderate
318	786	High

III. ANALYSIS

The following section describes the results of analysis and modeling efforts within the project area. Results are reported separately by study area.

Sierra Study Area

Environmental Setting

The Sierra lies in the northern portion of the Carson Ranger District extending south from Peavine Mountain to Mount Rose and west from Steamboat to Boca Ridge and the California state line north of Lake Tahoe (Figure 3.1). Elevations range from 10,776 feet (3285 meters) at Mount Rose to 4600 feet (1402 meters) in the Steamboat area. Approximately half of the study area consists of fan and piedmont slopes extending into the Truckee Meadows and Truckee River Canyon from the Carson Range. Vegetation communities change rapidly with elevation gain and precipitation regime. Stream courses are well incised and relatively competent. The Truckee River, Steamboat Hot Springs, Thomas Creek, Whites Creek, and Hunter Creek drainages dominate the hydrologic landscape. The Steamboat sinter source occurs along the lower portion of the Mount Rose fan.

Summary Cultural Resource Data

The Sierra encompasses approximately 167,000 acres (67,590 hectares) of which approximately 46% falls within Forest Service land (Table 3.1). Nineteen percent of the Sierra has been inventoried, while inventoried areas comprise approximately 14% of the total area under Forest Service management. Table 3.2 shows the relative percent of inventory within each of the environmental strata. As a general rule, at least 1% of each environmental zone has been inventoried.

Sierra Study Area

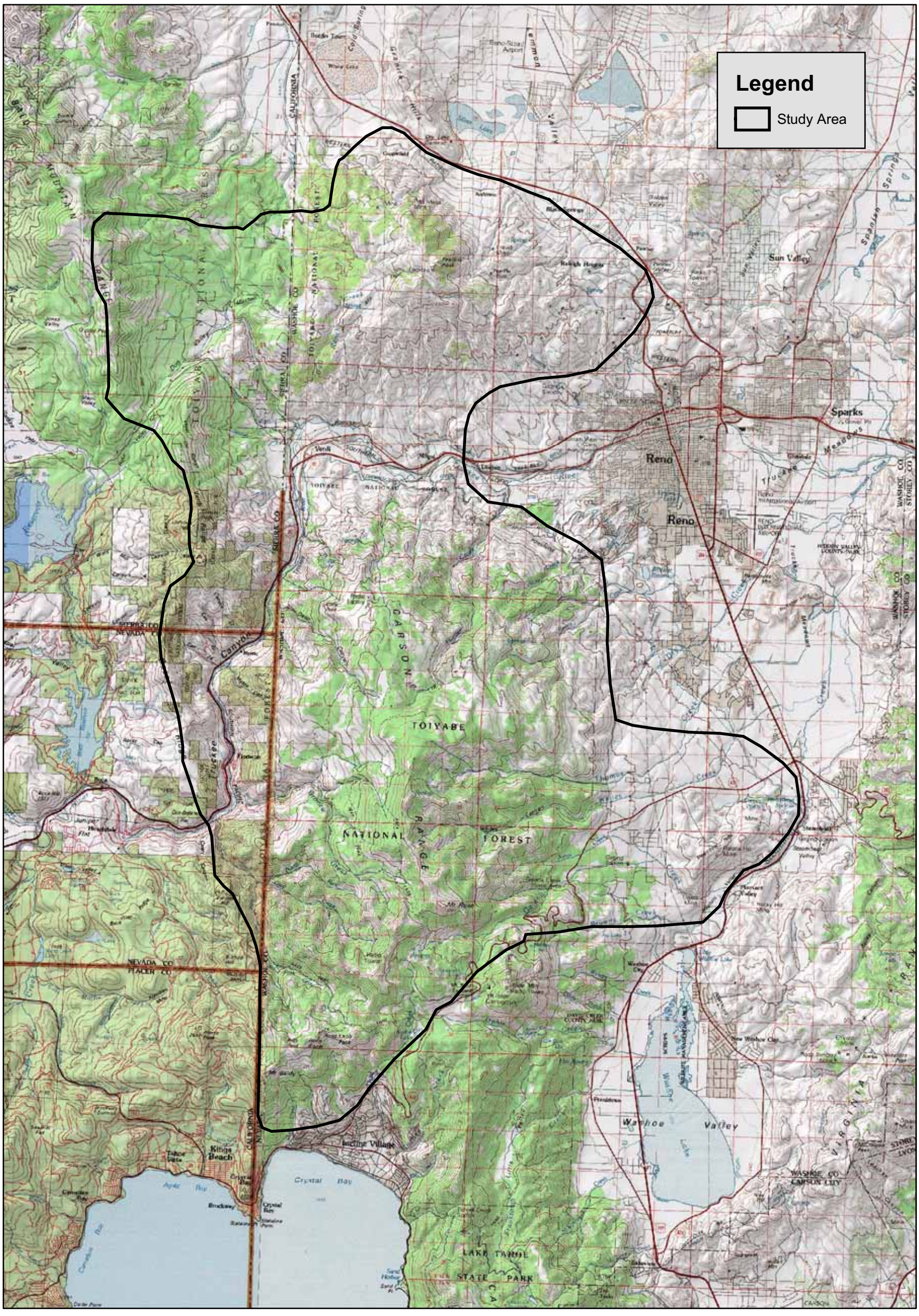


Table 3.1 Sierra Study Area Summary Inventory Data

	Project Area	Inventoried	% Inventoried	Forest Service	% Forest Service	Inventoried FS Grids	% FS Inventoried
Acres	167009	31628	18.9%	76602	45.9%	10746	14.0%
Hectares	67588	12800	18.9%	31000	45.9%	4349	14.0%

Table 3.2 Sierra Study Area Inventory Proportions

Slope in Degrees

	0-5	5-11	11+	Total
No Inventory	550152	1195892	3732765	5478809
Inventory	291017	296737	692202	1279956
Total Area	841169	1492629	4424967	6758765
Area %	12.45%	22.08%	65.47%	100.00%
Inventory %	22.74%	23.18%	54.08%	100.00%
% Total Area Inventoried	4.31%	4.39%	10.24%	18.94%

Inventory Against Elevation (500m Intervals, 10 Meter Cells)

	1000-1500	1500-2000	2000-2500	2500-3000	3000+	Total
No Inventory	95303	2598099	1834727	909428	41252	5478809
Inventory	139993	658134	222119	238715	20995	1279956
Total Area	235296	3256233	2056846	1148143	62247	6758765
Area %	3.48%	48.18%	30.43%	16.99%	0.92%	100.00%
Inventory %	10.94%	51.42%	17.35%	18.65%	1.64%	100.00%
% Total Area Inventoried	2.07%	9.74%	3.29%	3.53%	0.31%	18.94%

Inventory Against Distance From Perennial Water

	< 500 m	500 - 1000 m	1000 - 1500m	Over 1500m	Total
No Inventory	2468909	1629103	829371	551426	5478809
Inventory	835671	335723	73134	35428	1279956
Total Area	3304580	1964826	902505	586854	6758765
Area %	48.89%	29.07%	13.35%	8.68%	100.00%
Inventory %	65.29%	26.23%	5.71%	2.77%	100.00%
% Total Area Inventoried	12.36%	4.97%	1.08%	0.52%	18.94%

Inventory Against Gap

	Pinyon/Juniper	Conifer	Sage	Riparian	Deciduous	Agriculture	Urban	Mnt. Shrub	Chapparral	Scrub	Total
No Inventory	112336	3195097	1141183	8143	11362	40510	161154	254734	261843	292447	5478809
Inventory	26955	449039	367015	27038	59	14705	165167	184044	40345	5589	1279956
Total Area	139291	3644136	1508198	35181	11421	55215	326321	438778	302188	298036	6758765
Area %	2.06%	53.92%	22.31%	0.52%	0.17%	0.82%	4.83%	6.49%	4.47%	4.41%	100.00%
Inventory %	2.11%	35.08%	28.67%	2.11%	0.00%	1.15%	12.90%	14.38%	3.15%	0.44%	100.00%
% Total Area Inventoried	0.40%	6.64%	5.43%	0.40%	0.00%	0.22%	2.44%	2.72%	0.60%	0.08%	18.94%

When evaluated against environmental layers, slopes less than 5 degrees, areas within 500 meters of water, and those lying within sagebrush exhibit greater than expected site distribution (Table 3.3). Since over half of the study area lies between 1500 and 2000 meters and almost 75% of the sites, including all of the Mount Rose fan and Verdi site concentrations lie within that layer, elevation was not considered to be predictive. Chi square tables validate those distributional observations (Table 3.4).

Combined sensitivity scores for the Sierra ranged from 0 to 3 with 0 assigned to low sensitivity, 1 to moderate sensitivity, and 2-3 to high sensitivity zones. Figure 3.2 shows a 500 meter sensitivity grid for the area. High sensitivity zones correspond with the Mount Rose fan, Dog Valley, and Truckee River corridor. High steep areas have the lowest sensitivity.

When sites grids are added to the sensitivity map, correlations between site area and sensitivity are observed (Figure 3.3). Graphically, we see that the highest proportion of site areas fall within the high sensitivity zone (Figure 3.4). When evaluated against inventories, it appears that the highest proportion of inventories has occurred within zones of moderate sensitivity (Figure 3.5). Comparing the two graphs, one sees that even though a smaller proportion of inventories fall within high sensitivity zones, the highest proportion of sites still occur within that zone.

Table 3.5 correlates site densities within sensitivity zones for the Sierra. While only 15% of the study area lies within the high sensitivity zone, 67% of the sites are located within that area. Model area to site area ratios give an approximation of expected results for any give unit of inventory within the study area as a whole. For every 10 units of area within high sensitivity zones, 1 unit of site may be expected. Within low sensitivity zones, the ratio increases to over 300 to 1, with ratios in moderate zones at 83 to 1. Site densities within inventoried space provide a more realistic appraisal of expected site density within sensitivity zones. In the Sierra, for every 4 units of inventory within high sensitivity zones, 1 unit of site can be expected. Density of area inventoried to site increases to 18

Table 3.3 Sierra Study Area Inventory and Site Proportions

Slope in Degrees

	0-5	5-11	11+	Total
No Inventory	550152	1195892	3732765	5478809
Inventory	291017	296737	692202	1279956
Total Area	841169	1492629	4424967	6758765
Area %	12.45%	22.08%	65.47%	100.00%
Inventory %	22.74%	23.18%	54.08%	100.00%
%Total Area Inventoried	4.31%	4.39%	10.24%	18.94%
Sites	80039	50543	24520	155102
Site %	**51.60%**	32.59%	15.81%	100.00%
Inventoried Areas				
No Sites	787227	1460991	4411844	6660062
Sites	53942	31638	13123	98703
Site %	**54.65%**	32.05%	13.30%	100.00%
Weight		1	0	0

Inventory Against Elevation (500m Intervals, 10 Meter Cells)

	1000-1500	1500-2000	2000-2500	2500-3000	3000+	Total
No Inventory	95303	2598099	1834727	909428	41252	5478809
Inventory	139993	658134	222119	238715	20995	1279956
Total Area	235296	3256233	2056846	1148143	62247	6758765
Area %	3.48%	48.18%	30.43%	16.99%	0.92%	100.00%
Inventory %	10.94%	51.42%	17.35%	18.65%	1.64%	100.00%
%Total Area Inventoried	2.07%	9.74%	3.29%	3.53%	0.31%	18.94%
Sites	30744	112122	7450	4286	500	155102
Site %	19.82%	**72.29%**	4.80%	2.76%	0.32%	100.00%
Inventoried Areas						
No Sites	217608	3181973	2054555	1144179	61747	6660062
Sites	17688	74260	2291	3964	500	98703
Site %	17.92%	**75.24%**	2.32%	4.02%	0.51%	100.00%
Weight		0	0	0	0	0

Inventory Against Distance From Perennial Water

	< 500 m	500 - 1000 m	1000 - 1500m	Over 1500m	Total
No Inventory	2468909	1629103	829371	551426	5478809
Inventory	835671	335723	73134	35428	1279956
Total Area	3304580	1964826	902505	586854	6758765
Area %	48.89%	29.07%	13.35%	8.68%	100.00%
Inventory %	65.29%	26.23%	5.71%	2.77%	100.00%
%Total Area Inventoried	12.36%	4.97%	1.08%	0.52%	18.94%
Sites	90424	37200	17405	10073	155102
Site %	**58.30%**	23.98%	11.22%	6.49%	100.00%
Inventoried Areas					
No Sites	3245587	1938453	893389	582633	6660062
Sites	58993	26373	9116	4221	98703
Site %	**59.77%**	26.72%	9.24%	4.28%	100.00%
Weight		1	0	0	0

Inventory Against Gap

	Pinyon/Juniper	Conifer	Sage	Riparian	Deciduous	Agriculture	Urban	Mnt. Shrub	Chapparral	Scrub	Total
No Inventory	112336	3195097	1141183	8143	11362	40510	161154	254734	261843	292447	5478809
Inventory	26955	449039	367015	27038	59	14705	165167	184044	40345	5589	1279956
Total Area	139291	3644136	1508198	35181	11421	55215	326321	438778	302188	298036	6758765
Area %	2.06%	53.92%	22.31%	0.52%	0.17%	0.82%	4.83%	6.49%	4.47%	4.41%	100.00%
Inventory %	2.11%	35.08%	28.67%	2.11%	0.00%	1.15%	12.90%	14.38%	3.15%	0.44%	100.00%
%Total Area Inventoried	0.40%	6.64%	5.43%	0.40%	0.00%	0.22%	2.44%	2.72%	0.60%	0.08%	18.94%
Sites	453	14516	98957	2962	0	611	33310	3044	403	846	155102
Site %	0.29%	9.36%	**63.80%**	1.91%	0.00%	0.39%	21.48%	1.96%	0.26%	0.55%	100.00%
Inventoried Areas											
No Sites	138879	3635591	1447360	32676	11421	54662	303633	436344	301847	297649	6660062
Sites	412	8545	60838	2505	0	553	22688	2434	341	387	98703
Site %	0.42%	8.66%	**61.64%**	2.54%	0.00%	0.56%	22.99%	2.47%	0.35%	0.39%	100.00%
Weight		0	0	1	0	0	0	0	0	0	0

Table 3.4 Sierra Study Area Chi Squares

Carson Elevation

Cells on a 100 m Grid

	Site	Not Site	ROW
1000-1500	177	1223	1400
1500-2000	743	5839	6582
2000-2500	23	2198	7982
2500-3000	40	2348	2388
3000+	5	205	210
COL	988	11813	12801

Expected Values

	Site	Not Site
1000-1500	108.0540583	1291.945942
1500-2000	508.0084368	6073.991563
2000-2500	616.0624951	7365.937505
2500-3000	184.3093508	2203.690649
3000+	16.20810874	193.7918913

Cell Chi Values

	Site	Not Site
1000-1500	68.94594172	-68.9459417
1500-2000	234.9915632	-234.991563
2000-2500	-593.062495	-5167.9375
2500-3000	-144.309351	144.3093508
3000+	-11.2081087	11.20810874

Chi-Squares

	Site	Not Site
1000-1500	43.99226606	3.679366703
1500-2000	108.701019	9.091391416
2000-2500	570.9211742	3625.821973
2500-3000	112.9904079	9.450141627
3000+	7.750546567	0.648229917
Chi-Square for Table		4493.046516

Cell Standard Residual

	Site	Not Site
1000-1500	6.632666587	-1.91816754
1500-2000	10.42597808	-3.01519343
2000-2500	-23.8939569	-60.2147986
2500-3000	-10.6296946	3.074108265
3000+	-2.78398035	0.805127268

Cell Variance

	Site	Not Site
1000-1500	0.821893138	0.068740406
1500-2000	0.448325009	0.037496411
2000-2500	0.347399617	0.029055348
2500-3000	0.750668647	0.062783427

Carson Gap

Cells on a 100 m Grid

	Site	Not Site	ROW
P/J	4	265	269
Conifer	85	4405	4490
Sage	608	3062	4759
Riparian	25	245	270
Deciduous	0	1	1
Agriculture	6	142	271
Urban	227	1425	1652
Mtn. Shrub	24	1816	1840
Chapparral	3	400	3492
Scrub	3	52	55
COL	985	11813	12798

Expected Values

	Site	Not Site
P/J	20.70362557	248.2963744
Conifer	345.5735271	4144.426473
Sage	366.2771527	4392.722847
Riparian	20.78059072	249.2194093
Deciduous	0.076965151	0.923034849
Agriculture	20.85755587	250.1424441
Urban	127.1464291	1524.853571
Mtn. Shrub	141.6158775	1698.384123
Chapparral	268.7623066	3223.237693
Scrub	4.233083294	11813

Cell Chi Values

	Site	Not Site
P/J	-16.7036256	16.70362557
Conifer	-260.573527	260.5735271
Sage	241.7228473	-1330.72285
Riparian	4.219409283	-4.21940928
Deciduous	-0.07696515	0.076965151
Agriculture	-14.8575559	-108.142444
Urban	99.85357087	-99.8535709
Mtn. Shrub	-117.615877	117.6158775
Chapparral	-265.762307	-2823.23769
Scrub	-1.23308329	-11761

Chi-Squares

	Site	Not Site
P/J	13.47643707	1.123701897
Conifer	196.4807999	16.38310234
Sage	159.5238319	403.1265705
Riparian	0.856732849	0.07143671
Deciduous	0.076965151	0.006417563
Agriculture	10.58354909	46.75251441

Carson Landform

Cells on a 100 m Grid

	Site	Not Site	ROW
0-5	539	2371	2910
5-11	316	2651	2967
11+	131	6791	5877
COL	986	11813	12799

Expected Values

	Site	Not Site
0-5	224.1784514	2685.821549
5-11	228.5695757	2738.430424
11+	452.7480272	5424.251973

Cell Chi Values

	Site	Not Site
0-5	314.8215486	-314.821549
5-11	87.43042425	-87.4304243
11+	-321.748027	1366.748027

Chi-Squares

	Site	Not Site
0-5	442.1147831	36.90215662
5-11	33.44311709	2.79140891
11+	228.6521128	344.3793133
Chi-Square for Table		1088.282892

Cell Standard Residual

	Site	Not Site
0-5	21.0265257	-6.07471453
5-11	5.783002429	-1.670751
11+	-15.1212471	18.55745978

Cell Variance

	Site	Not Site
0-5	0.713116529	0.059521959
5-11	0.709006139	0.059178875
11+	0.499159936	0.041663565

Adjusted Standard Residual

	Site	Not Site
0-5	24.89930741	-24.8993074
5-11	6.867969801	-6.8679698
11+	-21.4026598	90.91599833
Sum		69.5133385

Carson H2O

Cells on a 100 m Grid

	Site	Not Site	ROW
<500	590	7767	8357
500-1000	264	3094	3358
1000-1500	91	640	11715
>1500	42	312	354
COL	987	11813	12800

Expected Values

	Site	Not Site
<500	644.4030469	7712.596953
500-1000	258.9332813	3099.066719
1000-1500	903.3363281	10811.66367
>1500	27.29671875	326.7032813

Cell Chi Values

	Site	Not Site
<500	-54.4030469	54.40304688
500-1000	5.06671875	-5.06671875
1000-1500	-812.336328	-10171.6637
>1500	14.70328125	-14.7032813

Chi-Squares

	Site	Not Site
<500	4.592919794	0.383747722
500-1000	0.099143836	0.008283668
1000-1500	730.5034564	9569.548683
>1500	7.919870571	0.661721176
Chi-Square for Table		10313.71783

Cell Standard Residual

	Site	Not Site
<500	-2.14310984	0.619473746
500-1000	0.314871143	-0.09101466
1000-1500	-27.0278274	-97.8240701
>1500	2.814226461	-0.81346246

Cell Variance

	Site	Not Site
<500	0.320343988	0.026765387
500-1000	0.680776038	0.056880212
1000-1500	0.078229401	0.006536224
>1500	0.897366931	0.074976819

Adjusted Standard Residual

	Site	Not Site
<500	-3.78648414	3.786484137
500-1000	0.381619651	-0.38161965

3000+	0.907679721	0.075915311

Adjusted Standard Residual

	Site	Not Site	
1000-1500	7.316114426	-7.31611443	
1500-2000	15.57113697	-15.571137	
2000-2500	-40.5390351	-353.256531	
2500-3000	-12.2686464	12.2686464	
3000+	-2.92213212	2.922132124	
	Sum		-393.795567

Urban	78.41931294	6.53881514
Mtn. Shrub	97.68321802	8.145091827
Chapparral	262.7957934	2472.877222
Scrub	0.359193124	11709.2289
Chi-Square for Table		15484.50961

Cell Standard Residual

	Site	Not Site
P/J	-3.67102671	1.060048064
Conifer	-14.0171609	4.047604518
Sage	12.63027442	-20.0780121
Riparian	0.925598644	-0.26727647
Deciduous	-0.27742594	0.080109695
Agriculture	-3.25323671	-6.83758103
Urban	8.855467969	-2.5571107
Mtn. Shrub	-9.88348208	2.853960726
Chapparral	-16.2109776	-49.7280326
Scrub	-0.59932723	-108.20919

Cell Variance

	Site	Not Site
P/J	0.903633664	0.075347427
Conifer	0.599200932	0.049963
Sage	0.579799746	0.048345276
Riparian	0.90356154	0.075341413
Deciduous	0.922962726	0.0753354
Agriculture	0.903489417	0.0753354
Urban	0.803887047	0.067030284
Mtn. Shrub	0.790327854	0.065899681
Chapparral	0.671180052	0.055964814
Scrub	0.919068064	0.076634389

Adjusted Standard Residual

	Site	Not Site	
P/J	-3.86181391	3.861813915	
Conifer	-18.108139	18.10813897	
Sage	16.58722654	-91.315329	
Riparian	0.973741862	-0.97374186	
Deciduous	-0.28877193	0.291867358	
Agriculture	-3.42258411	-24.9116755	
Urban	9.876748634	-9.87674863	
Mtn. Shrub	-11.1174794	11.11747944	
Chapparral	-19.7874433	-210.20534	
Scrub	-0.62515854	-390.887963	
	Sum		-724.565171

1000-1500	-96.6331499	-1209.99131	
>1500	2.970804079	-2.97080408	
	Sum		-1306.62446

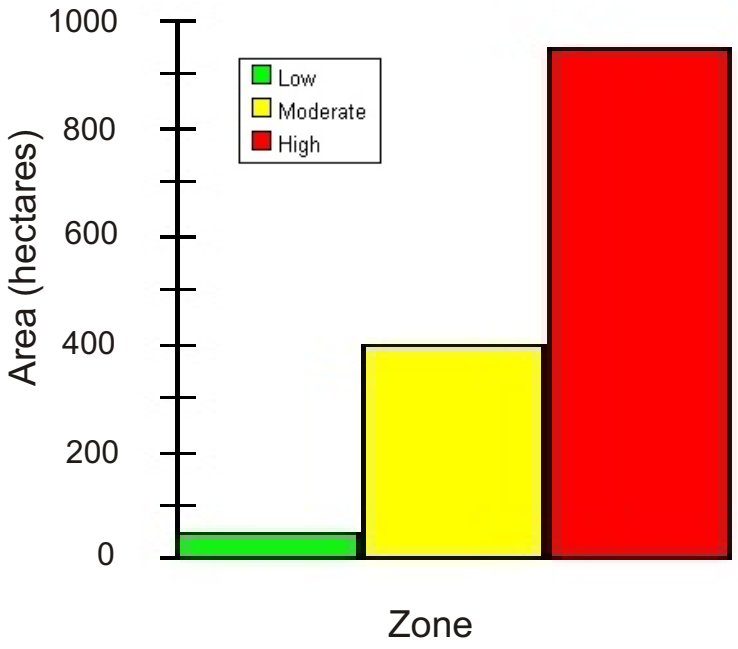
Sierra Study Area
Sensitivity

Redacted - Contains Sensitive Information

Sierra Study Area
Sites and Inventories within Sensitivity Zones

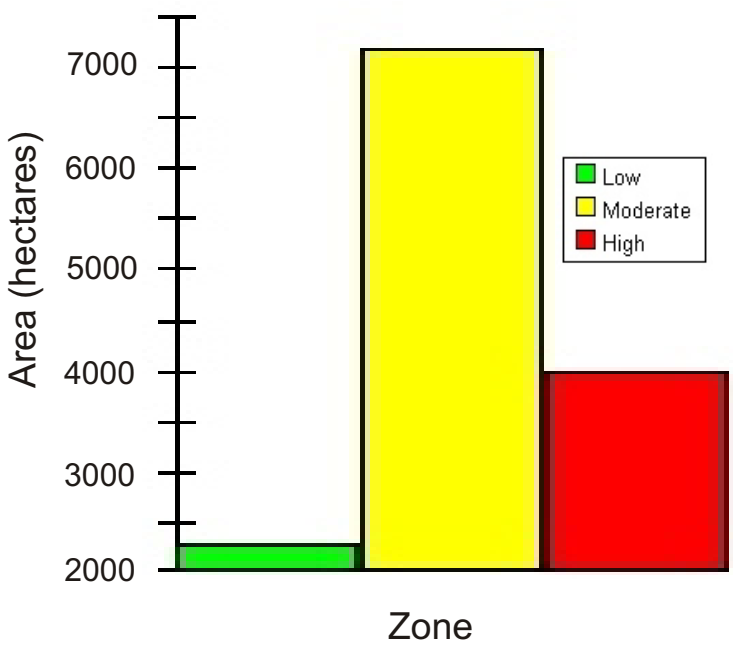
Redacted - Contains Sensitive Information

Inventoried Sites within Sierra Study Area



Hectares	Acres	Zone
50	124	Low
400	988	Moderate
950	2347	High

Inventories within Sierra Study Area



Hectares	Acres	Zone
2300	5683	Low
7175	17729	Moderate
4000	9884	High

Table 3.5 Sierra Study Area Summary Site Density by Sensitivity Zone

	High	Moderate	Low	Total
Model Area (m^2)	98,750,000	356,000,000	225,250,000	680,000,000
Model Area (ha)	9,875	35,600	22,525	68,000
Model Area (acres)	24,401	87,968	55,659	168,028
% Model Area	15%	52%	33%	100%
All Sites Area (m^2)	10,250,000	4,250,000	750,000	15,250,000
All Sites Area (ha)	1,025	425	75	1,525
All Site Area (acres)	2,533	1,050	185	3,768
% Site Area	67%	28%	5%	100%
Site Area : Model Area	0.10	0.01	0.00	0.02
Model Area : Site Area	**9.63**	**83.76**	**300.33**	**44.59**

Inventory Area (m^2)	40,000,000	71,750,000	23,000,000	134,750,000
Inventory Area (ha)	4,000	7,175	2,300	13,475
Inventory Area (acres)	9,884	17,729	5,683	33,297
% Inventory Area	29.68%	53.25%	17.07%	100.00%
Inventoried Site Area (m^2)	9,500,000	4,000,000	500,000	14,000,000
Inventory Site Area (ha)	950	400	50	1,400
Invnetory Site Area (acres)	2,347	988	124	3,459
	67.86%	28.57%	3.57%	100.00%
Inventoried Site : Inventory	0.2375	0.0557	0.0217	0.1039
Inventory : Inventoried Site	**4.21**	**17.94**	**46.00**	**9.63**

units of inventory to 1 unit of site within moderate zones, with densities in the low sensitivity zone reaching 46 to 1.

West Walker Study Area

The West Walker lies in the northern portion of the Bridgeport Ranger District, extending south from Topaz Lake to near Bridgeport, and from the crest of the Sierra Nevada Range east to the Wellington Hills and Sweetwater Mountains (Figure 3.6). Elevations range from near 11,000 feet (3350 meters) in the Sweetwater Mountains and Sierra Nevada Range to 5000 feet (1525 meters) in Antelope Valley near Topaz Lake. Bridgeport lies at an elevation of approximately 6500 feet (1980 meters). The Walker River and its tributaries comprise the major hydrographic feature of the study area, effectively bisecting the area between the Sierra Nevada and Sweetwater Mountains. Physiographically, the study area can be divided into quadrants including:

- Sonora Pass uplands - Pickle Meadow, and high steep slopes of the Sierra Nevada Range
- Slinkard Valley and Monitor Pass
- Antelope Valley
- Pinyon forested uplands of the Wellington Hills
- Sweetwater Mountains

Summary Cultural Resource Data

The West Walker covers approximately 2,358,800 acres (954,600 hectares) of which 5.4% is administered by the Forest Service (Table 3.6). Three and one-half percent of the study area has been surveyed for cultural resources; 5.3% of the Forest Service land has been inventoried. Table 3.7 shows the relative percent of inventory within each of the West Walker environmental zones. Inventory is biased towards the predominate strata within each environmental class. Sampling intensity within the West Walker creates some bias in the identification of predictive environmental zones.

West Walker Study Area

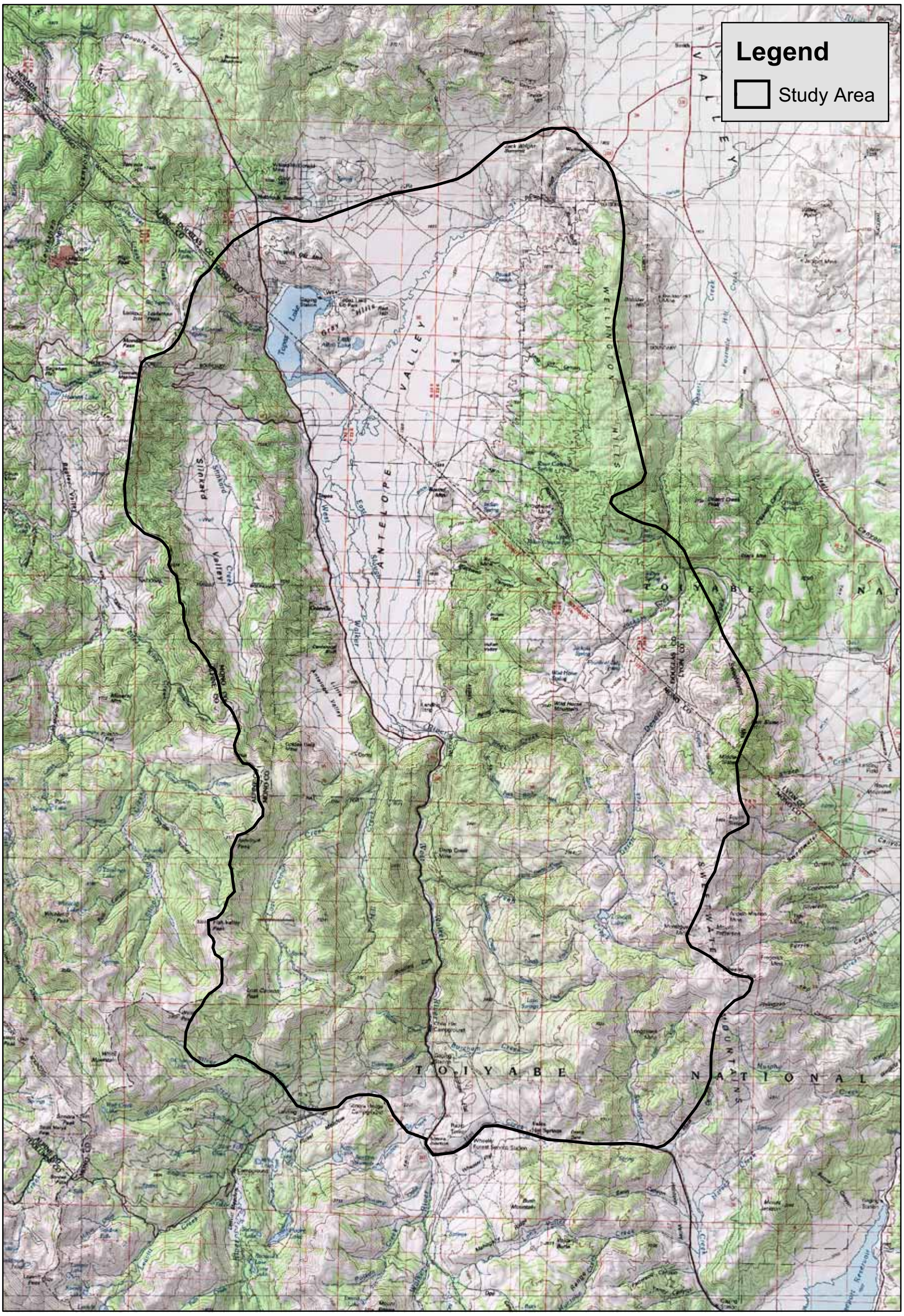


Table 3.6 West Walker Study Area Summary Inventory Data

	Project Area	Inventoried	% Inventoried	Forest Service	% Forest Service	Inventoried FS Grids	% FS Inventoried
Acres	2358817	83199	3.5%	127331	5.4%	6795	5.3%
Hectares	954600	33670	3.5%	51530	5.4%	2750	5.3%

Table 3.7 West Walker Study Area Inventory Proportions

Slope in Degrees

	0-3	3-11	11+	Total
No Inventory	1597843	2594970	5016280	9209093
Inventory	18411	130314	188135	336860
Total Area	1616254	2725284	5204415	9545953
Area %	16.93%	28.55%	54.52%	100.00%
Inventory %	5.47%	38.68%	55.85%	100.00%
% Total Area Inventoried	0.19%	1.37%	1.97%	3.53%

Inventory Against Elevation (500m Intervals)

	1000-1500	1500-2000	2000-2500	2500-3000	3000-3500	3500+	Total
No Inventory	10828	3749259	3153221	1910378	384143	1264	9209093
Inventory	69	145892	126542	59610	4675	72	336860
Total Area	10897	3895151	3279763	1969988	388818	1336	9545953
Area %	0.11%	40.80%	34.36%	20.64%	4.07%	0.01%	
Inventory %	0.02%	43.31%	37.57%	17.70%	1.39%	0.02%	
% Total Area Inventoried	0.00%	1.53%	1.33%	0.62%	0.05%	0.00%	3.53%

Inventory Against Distance From Perennial Water

	< 500 m	500 - 1000 m	1000 - 1500m	Over 1500m	Total
No Inventory	3198517	2403511	1555730	2051335	9209093
Inventory	123853	65050	38329	109628	336860
Total Area	3322370	2468561	1594059	2160963	9545953
Area %	34.80%	25.86%	16.70%	22.64%	100.00%
Inventory %	36.77%	19.31%	11.38%	32.54%	100.00%
% Total Area Inventoried	1.30%	0.68%	0.40%	1.15%	3.53%

Inventory Against Gap

	Pinyon/Juniper	Conifer	Meadow	Sage	Riparian	Water	Deciduous	Agriculture	Juniper	Barren	Urban	Mnt. Shrub	Scrub	Total
No Inventory	4292324	621329	1608	2841925	81364	73151	13291	780601	229416	249038	16796	8186	64	9209093
Inventory	251482	3197	1451	44229	0	123	0	4917	7773	17986	821	1	4880	336860
Total Area	4543806	624526	3059	2886154	81364	73274	13291	785518	237189	267024	17617	8187	4944	9545953
Area %	47.60%	6.54%	0.03%	30.23%	0.85%	0.77%	0.14%	8.23%	2.48%	2.80%	0.18%	0.09%	0.05%	100.00%
Inventory %	74.65%	0.95%	0.43%	13.13%	0.00%	0.04%	0.00%	1.46%	2.31%	5.34%	0.24%	0.00%	1.45%	100.00%
% Total Area Inventoried	2.63%	0.03%	0.02%	0.46%	0.00%	0.00%	0.00%	0.05%	0.08%	0.19%	0.01%	0.00%	0.05%	3.53%

Environmental layers that appear to be predictive for the West Walker include slopes between 0 to 3 degrees and 3 to 6 degrees, elevations between 1500 and 2000 meters, areas within 500 meters of water, and the conifer zone (Table 3.8). Slopes between 0 and 3 degrees exhibit the greatest proportional variation of any class and were weighted higher than other probability variables. Chi-square values (Table 3.9) generally validate that assessment.

Combined sensitivity scores for the West Walker range from 0 to 6. Values of 0 to 1 were assigned as low sensitivity, 2 to 3 were designated moderate sensitivity, and scores between 4 and 6 identify high sensitivity zones. Figure 3.7 displays the 500 meter sensitivity grid over the study area. Highest sensitivity occurs along the Walker River drainages as well as Slinkard and Antelope Valleys. Steep slopes within the surrounding ranges have lowest sensitivity. When sites are overlaid upon the sensitivity map correlations to predicted sensitivity are observed (Figure 3.8). The paucity of inventories and recorded sites within the study area is quite evident within this figure, but most sites appear to fall within the moderate and high sensitivity zone. Figure 3.9 shows the distribution of inventoried site areas by sensitivity zone. Most of the inventoried sites fall within the moderate sensitivity zone. Figure 3.10 shows that in fact, most of the inventories have been conducted within moderate sensitivity zones. When all sites are cross-tabulated by sensitivity zone (Figure 3.11) the greatest site areas fall within the high sensitivity zone.

Table 3.10 summarizes site densities for the West Walker. One-third of the study area lies within the high sensitivity zone, while 60% of the sites fall within that area. Site density is relatively low within the study area. Even within the high sensitivity zone over 250 units of area would have to be inventoried to encounter a single unit of site. Within moderate sensitivity zones a survey of 650 units should reveal 1 unit of site. To encounter 1 unit of site in the low sensitivity zone, over 2700 units of inventory would have to be examined. While no inventoried site areas were tallied within the West Walker low sensitivity zone, high sensitivity areas still retain the highest site density. For every 44

Table 3.8 West Walker Study Area Inventory and Site Proportions

Slope in Degrees

	0-3	3-6	6-11	11+	Total
No Inventory	1597843	1031415	1563555	5016280	9209093
Inventory	18411	46340	83974	188135	336860
Total Area	1616254	1077755	1647529	5204415	9545953
Area %	16.93%	11.29%	17.26%	54.52%	1
Inventory %	5.47%	13.76%	24.93%	55.85%	100.00%
%Total Area Inventoried	0.19%	0.49%	0.88%	1.97%	3.53%
Sites	8872	5032	3247	3270	20421
Site %	43.45%	24.64%	15.90%	16.01%	100.00%
Inventoried Areas					
No Sites	1614840	1075172	1646033	5203555	9539600
Sites	1414	2583	1496	860	6353
Site %	22.26%	40.66%	23.55%	13.54%	100.00%
Weight	1	1	0	0	

Inventory Against Elevation (500m Intervals)

	1000-1500	1500-2000	2000-2500	2500-3000	3000-3500	3500+	Total
No Inventory	10828	3749259	3153221	1910378	384143	1264	9209093
Inventory	69	145892	126542	59610	4675	72	336860
Total Area	10897	3895151	3279763	1969988	388818	1336	9545953
Area %	0.11%	40.80%	34.36%	20.64%	4.07%	0.01%	
Inventory %	0.02%	43.31%	37.57%	17.70%	1.39%	0.02%	
% Total Area Inventoried	0.00%	1.53%	1.33%	0.62%	0.05%	0.00%	3.53%
Sites	0	5216	14848	357	0	0	20421
Site %	0.00%	25.54%	72.71%	1.75%	0.00%	0.00%	
Inventoried Areas							
No Sites	10897	3891418	3277320	1969811	388818	1336	9539600
Sites	0	3733	2443	177	0	0	6353
Site %	0.00%	58.76%	38.45%	2.79%	0.00%	0.00%	
Weight	0	1	0	0	0	0	

Inventory Against Distance From Perennial Water

	< 500 m	500 - 1000 m	1000 - 1500m	Over 1500m	Total
No Inventory	3198517	2403511	1555730	2051335	9209093
Inventory	123853	65050	38329	109628	336860
Total Area	3322370	2468561	1594059	2160963	9545953
Area %	34.80%	25.86%	16.70%	22.64%	100.00%
Inventory %	36.77%	19.31%	11.38%	32.54%	100.00%
% Total Area Inventoried	1.30%	0.68%	0.40%	1.15%	3.53%
Sites	13250	1089	2259	3823	20421
Site %	64.88%	5.33%	11.06%	18.72%	100.00%
Inventoried Areas					
No Sites	3318995	2468506	1593786	2158313	9539600
Sites	3375	55	273	2650	6353
Site %	53.12%	0.87%	4.30%	41.71%	100.00%
Weight	1	0	0	0	

Inventory Against Gap

	Pinyon/Juniper	Conifer	Meadow	Sage	Riparian	Water	Deciduous	Agriculture	Juniper	Barren	Urban	Mnt. Shrub	Scrub	Total
No Inventory	4292324	621329	1608	2841925	81364	73151	13291	780601	229416	249038	16796	8186	64	9209093
Inventory	251482	3197	1451	44229	0	123	0	4917	7773	17986	821	1	4880	336860
Total Area	4543806	624526	3059	2886154	81364	73274	13291	785518	237189	267024	17617	8187	4944	9545953
Area %	47.60%	6.54%	0.03%	30.23%	0.85%	0.77%	0.14%	8.23%	2.48%	2.80%	0.18%	0.09%	0.05%	100.00%
Inventory %	74.65%	0.95%	0.43%	13.13%	0.00%	0.04%	0.00%	1.46%	2.31%	5.34%	0.24%	0.00%	1.45%	100.00%
% Total Area Inventoried	2.63%	0.03%	0.02%	0.46%	0.00%	0.00%	0.00%	0.05%	0.08%	0.19%	0.01%	0.00%	0.05%	3.53%
Sites	5633	1866	0	11330	0	0	124	24	1384	60	0	0	0	20421
Site %	27.58%	9.14%	0.00%	55.48%	0.00%	0.00%	0.61%	0.12%	6.78%	0.29%	0.00%	0.00%	0.00%	100.00%
Inventoried Areas														
No Sites	4540275	623307	3059	2884802	81364	73274	13291	785499	237017	266964	17617	8187	4944	9539600
Sites	3531	1219	0	1352	0	0	0	19	172	60	0	0	0	6353
Site %	55.58%	19.19%	0.00%	21.28%	0.00%	0.00%	0.00%	0.30%	2.71%	0.94%	0.00%	0.00%	0.00%	100.00%
Weight	0	1	0	0	0	0	0	0	0	0		0	0	

Table 3.9 West Walker Study Area Chi Squares

Bridgeport Elevation
Cells on a 100 m Grid

	Site	Not Site	ROW
1000-1500	0	1	1
1500-2000	37	1422	1459
2000-2500	24	1241	1460
2500-3000	2	594	596
3000-3500	0	47	47
3500+	0	1	1
COL	63	3306	3369

Expected Values

	Site	Not Site
1000-1500	0.02	0.98
1500-2000	27.28	1431.72
2000-2500	27.30	1432.70
2500-3000	11.15	584.85
3000-3500	0.88	46.12
3500+	0.02	0.98

Cell Chi Values

	Site	Not Site
1000-1500	-0.02	0.02
1500-2000	9.72	-9.72
2000-2500	-3.30	-191.70
2500-3000	-9.15	9.15
3000-3500	-0.88	0.88
3500+	-0.02	0.02

Chi-Squares

	Site	Not Site
1000-1500	0.02	0.00
1500-2000	3.46	0.07
2000-2500	0.40	25.65
2500-3000	7.50	0.14
3000-3500	0.88	0.02
3500+	0.02	0.00

Chi-Square for Table 38.16

Cell Standard Residual

	Site	Not Site
1000-1500	-0.14	0.02
1500-2000	1.86	-0.26
2000-2500	-0.63	-5.06
2500-3000	-2.74	0.38
3000-3500	-0.94	0.13
3500+	-0.14	0.02

Cell Variance

	Site	Not Site
1000-1500	0.98	0.02
1500-2000	0.56	0.01
2000-2500	0.56	0.01
2500-3000	0.81	0.02
3000-3500	0.97	0.02
3500+	0.98	0.02

Bridgeport Gap
Cells on a 100 m Grid

	Site	Not Site	ROW
P/J	35	2480	2515
Conifer	12	20	32
Meadow	0	15	15
Sage	14	429	443
Water	0	1	1
Agriculture	0	49	49
Juniper	2	76	78
Barren	1	179	180
Urban	0	8	8
Scrub	0	48	48
COL	64	3305	3369

Expected Values

	Site	Not Site
P/J	47.78	2467.22
Conifer	0.61	31.39
Meadow	0.28	14.72
Sage	8.42	434.58
Water	0.02	0.98
Agriculture	0.93	48.07
Juniper	1.48	76.52
Barren	3.42	176.58
Urban	0.15	7.85
Scrub	0.91	47.09

Cell Chi Values

	Site	Not Site
P/J	-12.78	12.78
Conifer	11.39	-11.39
Meadow	-0.28	0.28
Sage	5.58	-5.58
Water	-0.02	0.02
Agriculture	-0.93	0.93
Juniper	0.52	-0.52
Barren	-2.42	2.42
Urban	-0.15	0.15
Scrub	-0.91	0.91

Chi-Squares

	Site	Not Site
P/J	3.42	0.07
Conifer	213.49	4.13
Meadow	0.28	0.01
Sage	3.71	0.07
Water	0.02	0.00
Agriculture	0.93	0.02
Juniper	0.18	0.00
Barren	1.71	0.03
Urban	0.15	0.00
Scrub	0.91	0.02

Chi-Square forTable 229.16

Cell Standard Residual

Bridgeport Landform
Cells on a 100 m Grid

	Site	Not Site	ROW
0-3	14	170	184
3-6	26	438	464
6-11	15	825	648
11+	9	1873	1882
COL	64	3306	3370

Expected Values

	Site	Not Site
0-3	3.49	180.51
3-6	8.81	455.19
6-11	12.31	635.69
11+	35.74	1846.26

Cell Chi Values

	Site	Not Site
0-3	10.51	-10.51
3-6	17.19	-17.19
6-11	2.69	189.31
11+	-26.74	26.74

Chi-Squares

	Site	Not Site
0-3	31.58	0.61
3-6	33.53	0.65
6-11	0.59	56.37
11+	20.01	0.39

Chi-Square for Table 143.73

Cell Standard Residual

	Site	Not Site
0-3	5.62	-0.78
3-6	5.79	-0.81
6-11	0.77	7.51
11+	-4.47	0.62

Cell Variance

	Site	Not Site
0-3	0.93	0.02
3-6	0.85	0.02
6-11	0.79	0.02
11+	0.43	0.01

Adjusted Standard Residual

	Site	Not Site
0-3	5.84	-5.84
3-6	6.30	-6.30
6-11	0.86	60.62
11+	-6.80	6.80

Sum 61.49

Bridgeport H2O
Cells on a 100 m Grid

	Site	Not Site	ROW
<500	34	1205	1239
500-1000	1	650	651
1000-1500	3	381	1890
>1500	26	1070	1096
COL	64	3306	3370

Expected Values

	Site	Not Site
<500	23.53	1215.47
500-1000	12.36	638.64
1000-1500	35.89	1854.11
>1500	20.81	1075.19

Cell Chi Values

	Site	Not Site
<500	10.47	-10.47
500-1000	-11.36	11.36
1000-1500	-32.89	-1473.11
>1500	5.19	-5.19

Chi-Squares

	Site	Not Site
<500	4.66	0.09
500-1000	10.44	0.20
1000-1500	30.14	1170.40
>1500	1.29	0.03

Chi-Square for Table 1217.25

Cell Standard Residual

	Site	Not Site
<500	2.16	-0.30
500-1000	-3.23	0.45
1000-1500	-5.49	-34.21
>1500	1.14	-0.16

Cell Variance

	Site	Not Site
<500	0.62	0.01
500-1000	0.79	0.02
1000-1500	0.43	0.01
>1500	0.66	0.01

Adjusted Standard Residual

	Site	Not Site
<500	2.74	-2.74
500-1000	-3.63	3.63
1000-1500	-8.36	-374.61
>1500	1.40	-1.40

Sum -382.97

Adjusted Standard Residual

	Site	Not Site	
1000-1500	-0.14	0.14	
1500-2000	2.49	-2.49	
2000-2500	-0.85	-49.20	
2500-3000	-3.05	3.05	
3000-3500	-0.95	0.95	
3500+	-0.14	0.14	
	Sum		-50.05

	Site	Not Site
P/J	-1.85	0.26
Conifer	14.61	-2.03
Meadow	-0.53	0.07
Sage	1.93	-0.27
Water	-0.14	0.02
Agriculture	-0.96	0.13
Juniper	0.43	-0.06
Barren	-1.31	0.18
Urban	-0.39	0.05
Scrub	-0.95	0.13

Cell Variance

	Site	Not Site
P/J	0.25	0.00
Conifer	0.97	0.02
Meadow	0.98	0.02
Sage	0.85	0.02
Water	0.98	0.02
Agriculture	0.96	0.02
Juniper	0.93	0.02
Barren	0.98	0.02
Urban	0.97	0.02
Scrub	0.00	0.02

Adjusted Standard Residual

	Site	Not Site	
P/J	-3.71	3.71	
Conifer	14.82	-14.82	
Meadow	-0.54	0.54	
Sage	2.09	-2.09	
Water	-0.14	0.14	
Agriculture	-0.99	0.98	
Juniper	0.44	-0.43	
Barren	-1.32	1.36	
Urban	-0.40	0.39	
Scrub	-170886879.64	0.97	
	Sum		-170886878.64

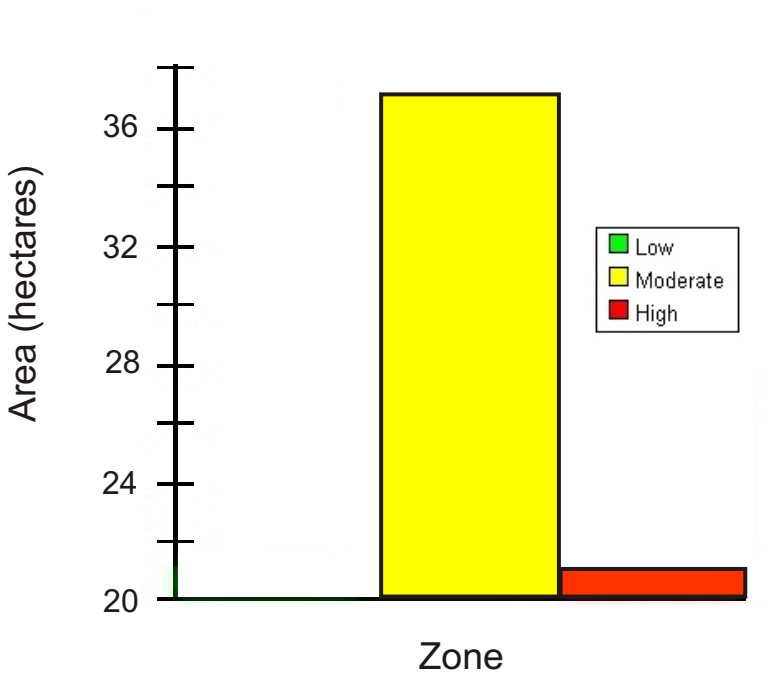
West Walker Study Area
Sensitivity

Redacted - Contains Sensitive Information

West Walker Study Area
Sites and Inventories within Sensitivity Zones

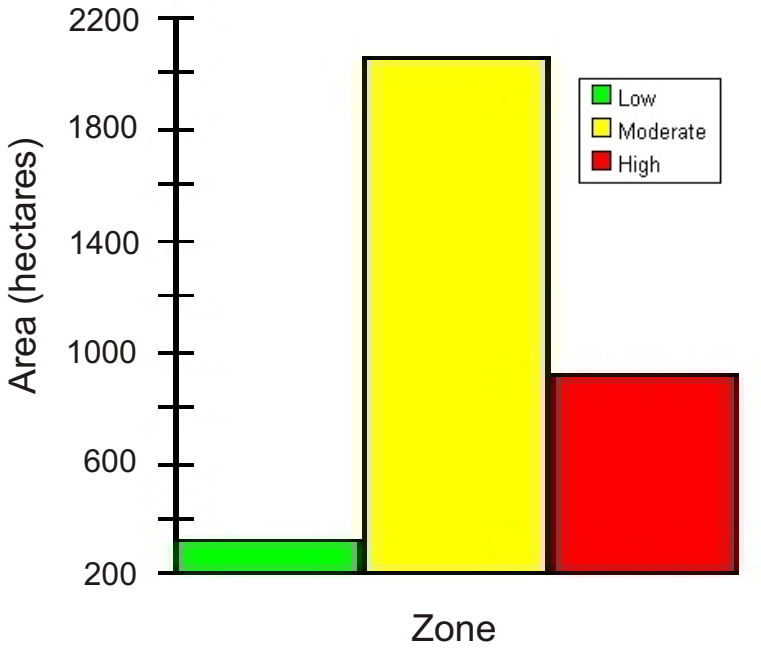
Redacted - Contains Sensitive Information

Inventoried Sites within West Walker Study Area



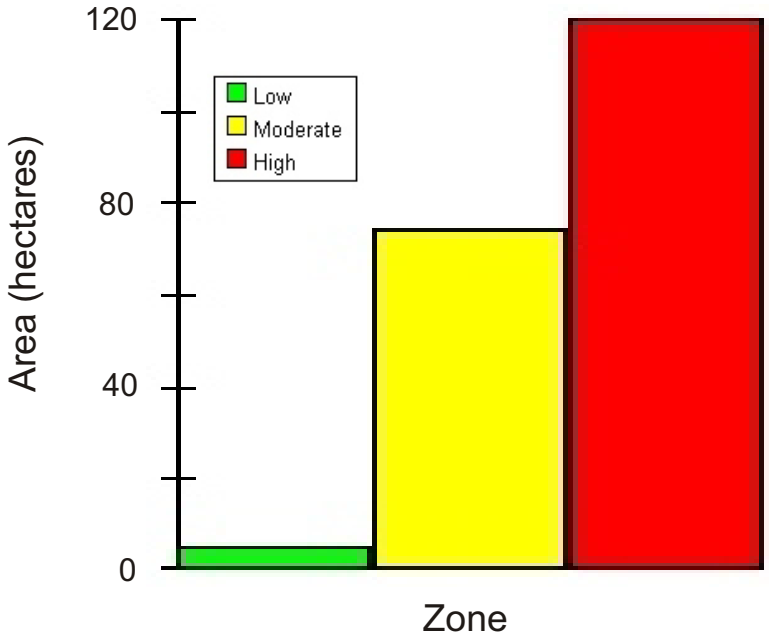
Hectares	Acres	Zone
0	0	Low
37	91	Moderate
21	52	High

Inventories
within West Walker Study Area



Hectares	Acres	Zone
327	808	Low
2054	5075	Moderate
927	2291	High

All Sites
within West Walker Study Area



Hectares	Acres	Zone
5	12	Low
74	183	Moderate
120	297	High

Table 3.10 West Walker Study Area Summary Site Density by Sensitivity Zone

	High	Moderate	Low	Total
Model Area (m^2)	310,249,984	481,249,984	136,000,000	927,499,968
Model Area (ha)	31,025	48,125	13,600	92,750
Model Area (acres)	76,663	118,917	33,606	229,185
% Model Area	33%	52%	15%	100%
All Sites Area (m^2)	1,200,000	740,000	50,000	1,990,000
All Sites Area (ha)	120	74	5	199
All Site Area (acres)	297	183	12	492
% Site Area	60%	37%	3%	100%
Site Area : Model Area	0.0039	0.0015	0.0004	0.0021
Model Area : Site Area	**258.54**	**650.34**	**2720.00**	**466.08**

Inventory Area (m^2)	9270000	20540000	3270000	33080000
Inventory Area (ha)	927	2054	327	3308
Invnetory Area (acres)	2291	5075	808	8174
% Inventory Area	28.02%	62.09%	9.89%	100.00%
Inventoried Site Area (m^2)	210000	370000	0	580000
Inventory Site Area (ha)	21	37	0	58
Invnetory Site Area (acres)	52	91	0	143
	36.21%	63.79%	0.00%	100.00%
Inventoried Site : Inventory	0.0227	0.0180		0.0175
Inventory : Inventoried Site	**44.14**	**55.51**		**57.03**

units of inventory, 1 unit of site can be expected while a single unit of site within areas of moderate sensitivity requires 55 units of inventory.

O'Neil Basin Study Area

The O'Neil Basin Study Area lies within the extreme eastern portion of the Jarbidge Ranger District in northeastern Nevada (Figure 3.12). It extends southward from Canyon Creek across the western portion of the O'Neil Basin and into the Snake Mountains. The western extent generally follows the crest of the Jarbidge Mountains. Elevations range from around 10,000 feet (3000 meters) in the Jarbidge Mountains to 5800 feet (1760 meters) along the southern study area boundary. The O'Neil Basin lies at 6200 feet (1890 meters).

Mary's River and its tributaries drain the southern portion of the study area while Cottonwood Creek and Canyon Creek flow eastward through the O'Neil Basin. With the exception of the extreme northern portion of the study area, hydrographic features flow into the Great Basin. Headwaters in the northwest portion of the study area are part of the Snake River drainage.

Vegetation ranges from open sage lands over most of the study area, but changes to open conifer woodlands in the Jarbidge Mountains. Topographically, the area is characterized by well incised alluvial fans and deeply cut stream channels. The Jarbidge Mountains are uniformly steep. The O'Neil Basin is a major obsidian source locale in the northeastern Great Basin.

The study area covers approximately 278,300 acres (112,640 hectares) of which approximately 26% is Forest Service land (Table 3.11). A little more than 2% of the study area has been inventoried, with inventories on Forest Service land comprising a 1% sample. When evaluated against environmental strata, a little less than 1% of each class has been inventoried (Table 3.12).

O'Neil Basin Study Area

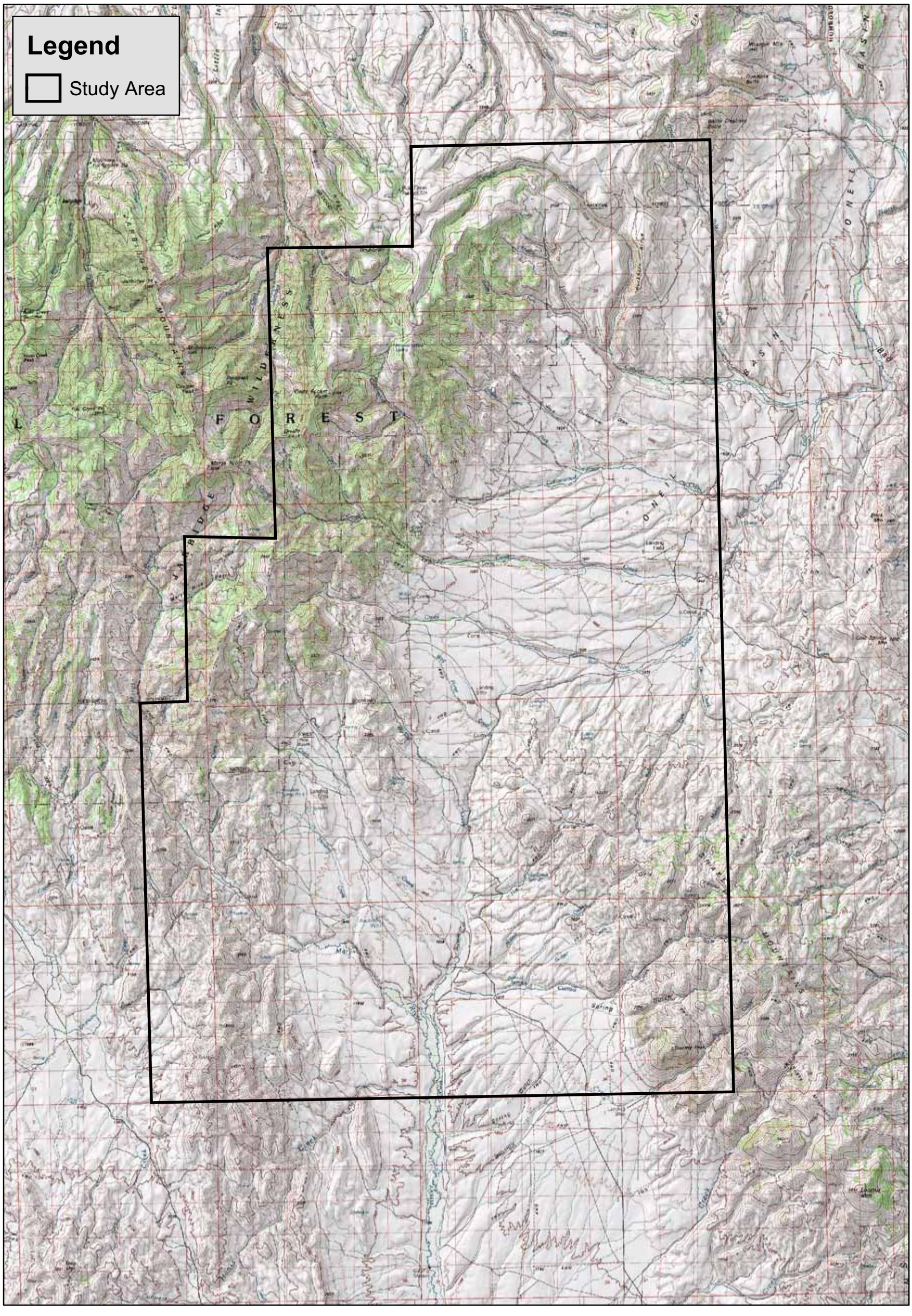


Table 3.11 O'Neil Basin Study Area Summary Inventory Data

	Project Area	Inventoried	% Inventoried	Forest Service	% Forest Service	Inventoried FS Grids	% FS Inventoried
Acres	278328	6341	2.3%	74068	26.6%	741	1.0%
Hectares	112638	2566	2.3%	29975	26.6%	300	1.0%

Table 3.12 O'Neil Basin Study Area Inventory Proportions

Slope in Degrees

	0-5	5-11	11+	Total
No Inventory	4040320	2067082	4899797	11007199
Inventory	95473	75519	85649	256641
Total Area	4135793	2142601	4985446	11263840
Area %	36.72%	19.02%	44.26%	100.00%
Inventory %	37.20%	29.43%	33.37%	100.00%
% Total Area Inventoried	0.85%	0.67%	0.76%	2.28%

Inventory Against Elevation (500m Intervals)

	1500-2000	2000-2500	2500-3000	3000+	Total
No Inventory	5225912	4855503	919148	6636	11007199
Inventory	77360	142213	37068	0	256641
Total Area	5303272	4997716	956216	6636	11263840
Area %	47.08%	44.37%	8.49%	0.06%	100.00%
Inventory %	30.14%	55.41%	14.44%	0.00%	100.00%
% Total Area Inventoried	0.69%	1.26%	0.33%	0.00%	2.28%

Inventory Against Distance From Perennial Water

	< 500 m	500 - 1000 m	1000 - 1500m	Over 1500m	Total
No Inventory	4289049	3411986	1909062	1397102	11007199
Inventory	115404	73902	43347	23988	256641
Total Area	4404453	3485888	1952409	1421090	11263840
Area %	39.10%	30.95%	17.33%	12.62%	100.00%
Inventory %	44.97%	28.80%	16.89%	9.35%	100.00%
% Total Area Inventoried	1.02%	0.66%	0.38%	0.21%	2.28%

Inventory Against Gap

	Conifer	Sage	Deciduous	Agriculture	Mtn.Shrub	Total
No Inventory	276412	9018766	587948	274135	849938	11007199
Inventory	9129	196271	19450	3375	28416	256641
Total Area	285541	9215037	607398	277510	878354	11263840
Area %	2.54%	81.81%	5.39%	2.46%	7.80%	100.00%
Inventory %	3.56%	76.48%	7.58%	1.32%	11.07%	100.00%
% Total Area Inventoried	0.08%	1.74%	0.17%	0.03%	0.25%	2.28%

Areas within 500 meters of water, slopes between 0 and 5 degrees and 5 to 11 degrees, and elevations between 1500 and 2000 meters appear to be predictive for sites within the O'Neil Basin study area (Table 3.13). Sagebrush covers over 80% of the study area, but a similar frequency of sites suggests that the class is not predictive. Distance to water was weighted slightly higher (2) than the other predictive classes. Chi square tables suggest similar trends (Table 3.14).

Combined sensitivity scores range from 1 to 5 for the study area. Grids scoring 1 or lower were identified as low sensitivity zones, scores between 2 and 3 were moderate, and 4 to 5 were classified as zones of high sensitivity. Zones of highest sensitivity generally occur along broader reaches of established water courses in the O'Neil Basin and adjoining lowlands (Figure 3.13). Moderate sensitivity zones continue upstream into the steeper surrounding ranges and along more deeply incised tributaries. Steep uplands generally have lowest sensitivity scores.

When sites are projected over the sensitivity map (Figure 3.14), it appears that most of the larger sites occur within high or moderate sensitivity zones. Several clusters of sites are also apparent in low sensitivity zones within the northern uplands of the study area. A check of site records confirms that sites within that area are potential lithic procurement locations.

When all sites within the study area are cross-tabulated against sensitivity, cumulative site areas are highest in zones of moderate sensitivity. Slightly less site area falls within the high sensitivity zone (Figure 3.15). Very little site area occurs within predicted low sensitivity zones. When tabulated against inventory area, the greatest frequencies of inventories are conducted within moderate sensitivity zones, suggesting a correlation between inventory intensity and site density for the study area (Figure 3.16). When inventoried sites are considered (Figure 3.17), the correlation within moderate sensitivity zones remain, but a disproportionate frequency of site to inventory area is evident within high sensitivity zones.

Figure 3.13 O'Neil Basin Study Area Inventory and Site Proportions

Slope in Degrees

	0-5	5-11	11+	Total
No Inventory	4040320	2067082	4899797	11007199
Inventory	95473	75519	85649	256641
Total Area	4135793	2142601	4985446	11263840
Area %	**36.72%**	**19.02%**	44.26%	100.00%
Inventory %	37.20%	29.43%	33.37%	100.00%
% Total Area Inventoried	0.85%	0.67%	0.76%	2.28%
Sites	22953	15187	10125	48265
Site %	**47.56%**	**31.47%**	20.98%	100.00%
Inventoried Areas				
No Sites	4128430	2136394	4979516	11244340
Sites	7363	6207	5930	19500
Site %	**37.76%**	**31.83%**	30.41%	100.00%
Weight	**1**	**1**	0	

Inventory Against Elevation (500m Intervals)

	1500-2000	2000-2500	2500-3000	3000+	Total
No Inventory	5225912	4855503	919148	6636	11007199
Inventory	77360	142213	37068	0	256641
Total Area	5303272	4997716	956216	6636	11263840
Area %	**47.08%**	44.37%	8.49%	0.06%	100.00%
Inventory %	30.14%	55.41%	14.44%	0.00%	100.00%
% Total Area Inventoried	0.69%	1.26%	0.33%	0.00%	2.28%
Sites	32042	11876	4347	0	48265
Site %	**66.39%**	24.61%	9.01%	0.00%	100.00%
Inventoried Areas					
No Sites	5293052	4991501	953151	6636	11244340
Sites	10220	6215	3065	0	19500
Site %	**52.41%**	31.87%	15.72%	0.00%	100.00%
Weight	**1**	0	0	0	

Inventory Against Distance From Perennial Water

	< 500 m	500 - 1000 m	1000 - 1500m	Over 1500m	Total
No Inventory	4289049	3411986	1909062	1397102	11007199
Inventory	115404	73902	43347	23988	256641
Total Area	4404453	3485888	1952409	1421090	11263840
Area %	**39.10%**	30.95%	17.33%	12.62%	100.00%
Inventory %	44.97%	28.80%	16.89%	9.35%	100.00%
% Total Area Inventoried	1.02%	0.66%	0.38%	0.21%	2.28%
Sites	27318	8898	5645	6404	48265
Site %	**56.60%**	18.44%	11.70%	13.27%	100.00%
Inventoried Areas					
No Sites	4391883	3482362	1949733	1420362	11244340
Sites	12570	3526	2676	728	19500
Site %	**64.46%**	18.08%	13.72%	3.73%	100.00%
Weight		**2**	0	0	0

Inventory Against Gap

	Conifer	Sage	Deciduous	Agriculture	Mtn. Shrub	Total
No Inventory	276412	9018766	587948	274135	849938	11007199
Inventory	9129	196271	19450	3375	28416	256641
Total Area	285541	9215037	607398	277510	878354	11263840
Area %	2.54%	81.81%	5.39%	2.46%	7.80%	100.00%
Inventory %	3.56%	76.48%	7.58%	1.32%	11.07%	100.00%
% Total Area Inventoried	0.08%	1.74%	0.17%	0.03%	0.25%	2.28%
Sites	335	40630	3256	351	3693	48265
Site %	0.69%	84.18%	6.75%	0.73%		100.00%
Inventoried Areas						
No Sites	285206	9201495	604612	277298	875729	11244340
Sites	335	13542	2786	212	2625	19500
Site %	1.72%	69.45%	14.29%	1.09%		100.00%
Weight		0	0	0	0	0

Table 3.14 O'Neil Basin Study Area Chi Squares

O'Neil Elevation

Cells on a 100 m Grid

	Site	Not Site	ROW
1500-2000	102	671	773
2000-2500	62	1360	773
2500-3000	31	340	371
COL	195	2371	2566

Expected Values

	Site	Not Site
1500-2000	58.74	714.26
2000-2500	58.74	714.26
2500-3000	28.19	342.81

Cell chi Values

	Site	Not Site
1500-2000	43.26	-43.26
2000-2500	3.26	645.74
2500-3000	2.81	-2.81

Chi-Squares

	Site	Not Site
1500-2000	31.85	2.62
2000-2500	0.18	583.80
2500-3000	0.28	0.02

Chi-Square for Table 618.76

Cell Standard Residual

	Site	Not Site
1500-2000	5.64	-1.62
2000-2500	0.42	24.16
2500-3000	0.53	-0.15

Cell Variance

	Site	Not Site
1500-2000	0.65	0.05
2000-2500	0.65	0.05
2500-3000	0.79	0.07

Adjusted Standard Residual

	Site	Not Site
1500-2000	7.02	-7.02
2000-2500	0.53	104.85
2500-3000	0.59	-0.59

Sum 105.38

O'Neil Gap

Cells on a 100 m Grid

	Site	Not Site	ROW
Conifer	3	88	91
Sage	135	1827	1962
Deciduous	28	167	195
Agriculture	2	32	34
Mtn. Shrub	26	258	284
COL	194	2372	2566

Expected Values

	Site	Not Site
Conifer	6.88	84.12
Sage	148.34	1813.66
Deciduous	14.74	180.26
Agriculture	2.57	31.43
Mtn. Shrub	21.47	262.53

Cell Chi Values

	Site	Not Site
Conifer	-3.88	3.88
Sage	-13.34	13.34
Deciduous	13.26	-13.26
Agriculture	-0.57	0.57
Mtn. Shrub	4.53	-4.53

Chi-Squares

	Site	Not Site
Conifer	2.19	0.18
Sage	1.20	0.10
Deciduous	11.92	0.98
Agriculture	0.13	0.01
Mtn. Shrub	0.96	0.08

Chi-Square for Table 17.73

Cell Standard Residual

	Site	Not Site
Conifer	-1.48	0.42
Sage	-1.09	0.31
Deciduous	3.45	-0.99
Agriculture	-0.36	0.10
Mtn. Shrub	0.98	-0.28

Cell Variance

	Site	Not Site
Conifer	0.89	0.07
Sage	0.22	0.02
Deciduous	0.85	0.07

O'Neil Landform

Cells on a 100 m Grid

	Site	Not Site	ROW
0-5	74	881	955
5-11	62	693	755
11+	59	797	1710
COL	195	2371	2566

Expected Values

	Site	Not Site
0-5	72.57	882.43
5-11	57.38	697.62
11+	129.95	1580.05

Cell Chi Values

	Site	Not Site
0-5	1.43	-1.43
5-11	4.62	-4.62
11+	-70.95	-783.05

Chi-Squares

	Site	Not Site
0-5	0.03	0.00
5-11	0.37	0.03
11+	38.74	388.07

Chi-Square for Table 427.24

Cell Standard Residual

	Site	Not Site
0-5	0.17	-0.05
5-11	0.61	-0.18
11+	-6.22	-19.70

Cell Variance

	Site	Not Site
0-5	0.58	0.05
5-11	0.65	0.05
11+	0.31	0.03

Adjusted Standard Residual

	Site	Not Site
0-5	0.22	-0.22
5-11	0.76	-0.76
11+	-11.21	-123.72

Sum -134.94

O'Neil Water

Cells on a 100 m Grid

	Site	Not Site	ROW
<500	126	1028	1154
500-1000	35	704	739
1000-1500	27	407	1893
>1500	7	233	240
COL	195	2372	2567

Expected Values

	Site	Not Site
<500	87.66	1066.34
500-1000	56.14	682.86
1000-1500	143.80	1749.20
>1500	18.23	221.77

Cell Chi Values

	Site	Not Site
<500	38.34	-38.34
500-1000	-21.14	21.14
1000-1500	-116.80	-1342.20
>1500	-11.23	11.23

Chi-Squares

	Site	Not Site
<500	16.77	1.38
500-1000	7.96	0.65
1000-1500	94.87	1029.90
>1500	6.92	0.57

Chi-Square for Table 1159.01

Cell Standard Residual

	Site	Not Site
<500	4.09	-1.17
500-1000	-2.82	0.81
1000-1500	-9.74	-32.09
>1500	-2.63	0.75

Cell Variance

	Site	Not Site
<500	0.51	0.04
500-1000	0.66	0.05
1000-1500	0.24	0.02
>1500	0.84	0.07

Adjusted Standard Residual

	Site	Not Site
<500	5.74	-5.74
500-1000	-3.48	3.48

Agriculture	0.91	0.07	
Mtn. Shrub	0.82	0.07	

Adjusted Standard Residual

	Site	Not Site	
Conifer	-1.57	1.57	
Sage	-2.35	2.35	
Deciduous	3.74	-3.62	
Agriculture	-0.37	0.37	
Mtn. Shrub	1.08	-1.08	
	Sum		0.12

1000-1500	-19.77	-227.24	
>1500	-2.87	2.87	
	Sum		-247.01

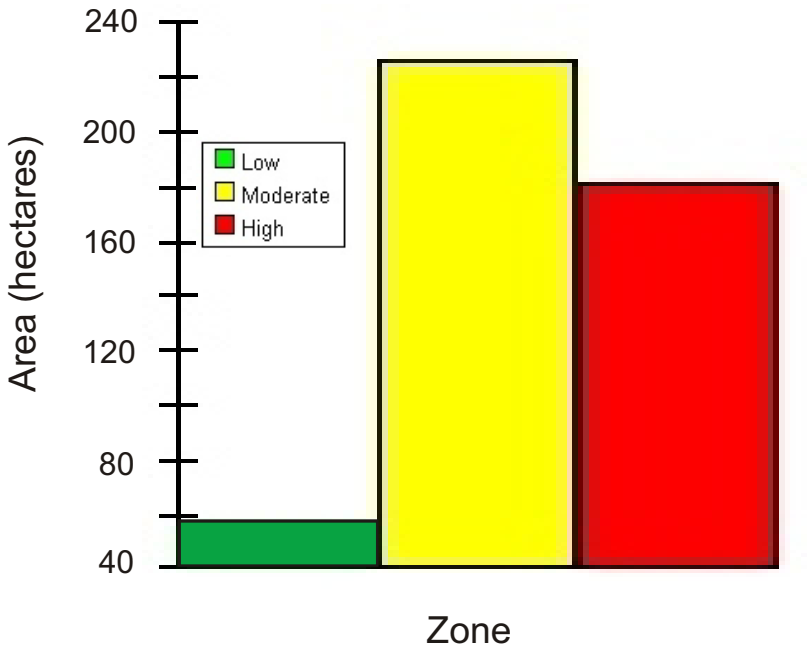
O'Neil Basin Study Area
Sensitivity

Redacted - Contains Sensitive Information

O'Neil Basin Study Area
Sites and Inventories within Sensitivity Zones

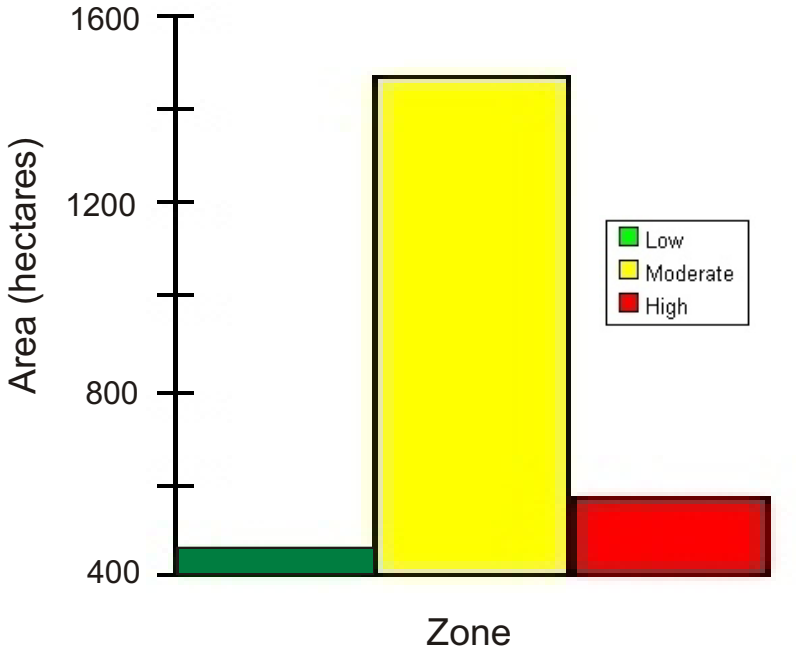
Redacted - Contains Sensitive Information

All Sites
within O'Neil Basin Study Area



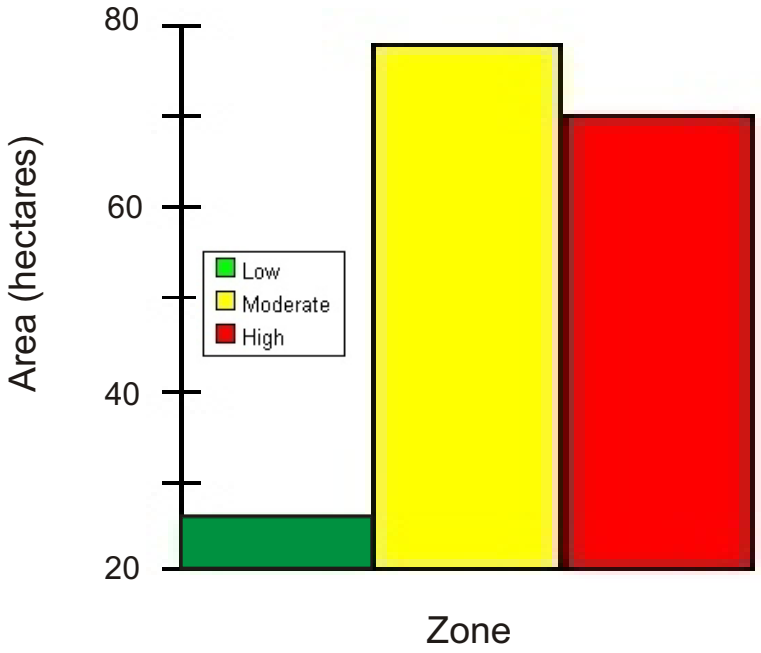
Hectares	Acres	Zone
57	141	Low
226	558	Moderate
181	447	High

Inventories
within O'Neil Basin Study Area



Hectares	Acres	Zone
464	1147	Low
1469	3630	Moderate
576	1423	High

Inventoried Sites within O'Neil Basin Study Area



Hectares	Acres	Zone
26	64	Low
78	193	Moderate
70	173	High

Table 3.15 relates site area to unit area inventoried within the study area. When all sites are considered within the model area, for every 100 units of inventory, 1 site unit might be encountered. Site density decreases incrementally in roughly 200 unit increments through moderate and low sensitivity zones. When only inventoried space is considered, site area to unit area ratios decrease with highest densities (8:1) composing high sensitivity areas. Low and moderate sensitivity zones are somewhat similar with a slightly higher yield within low sensitivity areas. That transposition is likely due to the lithic source bias.

Santa Rosa Study Area

Environmental Setting

The Santa Rosa lies in northeastern Humboldt County and includes all of the Santa Rosa Ranger District (Figure 3.18). It extends over most of the Santa Rosa Range uplands and lies between elevation of 4900 feet (1500 meters) and 9700 feet (2950 meters). Martin Creek and the Little Humboldt River drain Paradise Valley to the east of the Santa Rosa Range. The Quinn River is the major hydrographic feature of the Quinn River Valley to the west. Drainages in the northeast quadrant of the study area flow northward towards the Owhyee River.

The study area can be divided into two distinct topographic zones. The southern half of the study area is characterized by steep granitic slopes and high mountain basins, while the northern zone is relatively flat consisting of broad mesas and basalt outcrops. Vegetation varies with elevation, but is generally dominated by sagebrush.

Summary Cultural Resource Data

The study area includes approximately 320,000 acres (129,500 hectares) most of which lie within Forest Service land (Table 3.16). Slightly more than 0.5% of the study area has

Table 3.15 O'Neil Basin Study Area Summary Site Density by Sensitivity Zone

	High	Moderate	Low	Total
Model Area (m^2)	183,000,000	636,000,000	304,500,000	1,123,500,000
Model Area (ha)	18,300	63,600	30,450	112,350
Model Area (acres)	45,219	157,156	75,242	277,617
% Model Area	16%	57%	27%	100%
All Sites Area (m^2)	1,815,000	2,262,500	570,000	4,647,500
All Sites Area (ha)	182	226	57	465
All Site Area (acres)	448	559	141	1,148
% Site Area	39%	49%	12%	100%
Site Area : Model Area	0.0099	0.0036	0.0019	0.0041
Model Area : Site Area	**100.83**	**281.10**	**534.21**	**241.74**

Inventory Area (m^2)	5,760,000	14,690,000	4,640,000	25,090,000
Inventory Area (ha)	576	1,469	464	2,509
Inventory Area (acres)	1,423	3,630	1,147	6,200
% Inventory Area	22.96%	58.55%	18.49%	100.00%
Inventoried Site Area (m^2)	702,500	777,500	260,000	1,740,000
Inventory Site Area (ha)	70	78	26	174
Inventory Site Area (acres)	173	193	64	430
% Inventory Site Area	40.37%	44.68%	14.94%	100.00%
Inventoried Site : Inventory	0.1220	0.0529	0.0560	0.0694
Inventory : Inventoried Site	**8.20**	**18.89**	**17.85**	**14.42**

Santa Rosa Study Area

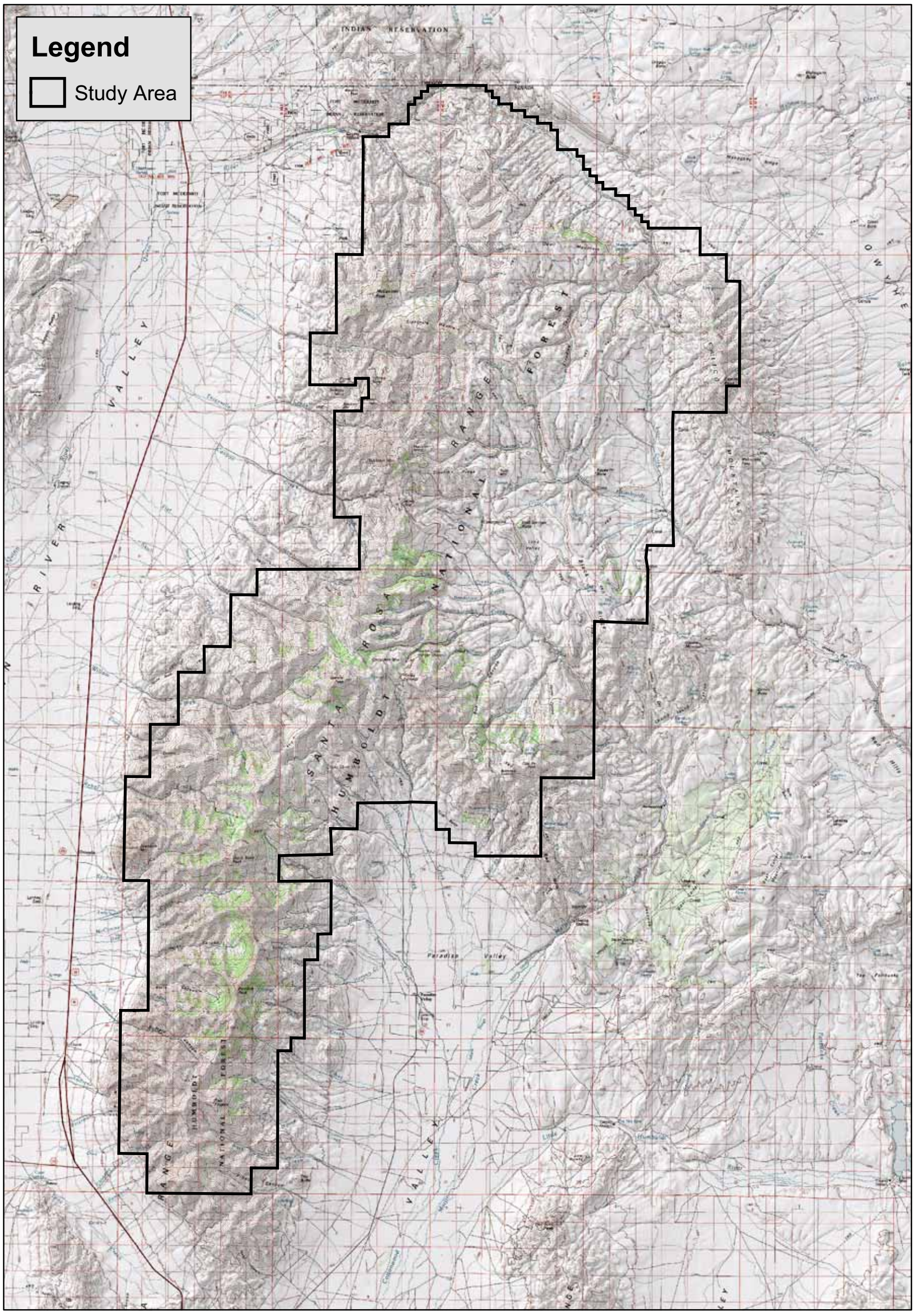


Table 3.16 Santa Rosa Study Area Summary Inventory Data

	Study Area	Inventoried	% Inventoried
Acres	320177	1757	0.5%
Hectares	129574	711	0.5%

been inventoried. The paucity of inventory extends through all environmental classes, where classes that dominate in extent also dominate in area inventoried (Table 3.17). Areas with no inventory were not included in the weighted sensitivity matrix.

Slope, elevation, and distance to water were considered to be predictive environmental layers for prehistoric sites in the Santa Rosa (Table 3.18). Predictive classes for slope included ranges between 0 to 5 and 5 to 11 degrees. Elevations between 1500 and 2000 meters were considered to be predictive as were areas within 500 meters of water. Nearly all sites and inventories within the study area are located within the sagebrush vegetation zone. While chi square tables (Table 3.19) indicate that sites within sagebrush are not normally distributed, that class was not weighted due to the inventory bias.

Combined sensitivity scores for the Santa Rosa range from 1 to 4. Cells with a cumulative score of 1 characterize the low sensitivity zone, scores of 2 characterize the moderate zone, and scores of 3 and 4 are assigned to high sensitivity. Flat areas near water are generally highest sensitivity, with moderate sensitivity extending along water courses into steeper slopes (Figure 3.19). Low sensitivity areas occur on high, steep slopes.

Site plots over sensitivity show a good correlation between high sensitivity zones and sites (Figure 3.20). By site area, when all sites within the study area are considered, highest frequencies occur within the high sensitivity zone (Figure 3.21). The pattern prevails when only sites within inventories are considered (Figure 3.22). When sensitivity is evaluated against inventories, it is apparent that most inventories have been conducted within low sensitivity zone (Figure 3.23). Comparing inventory results, the small amount of survey within high sensitivity zones yield the highest frequency of site area.

Table 3.20 correlates site density for the Santa Rosa. When all sites within the study area are considered, for every 55 units of area, a single unit of site might be encountered. When actual inventoried space is considered, densities increase greatly. For every 10 units of inventoried space within high sensitivity zones a single unit of site will be

Table 3.17 Santa Rosa Study Area Inventory Proportions

Slope in Degrees

	0-5	5-11	11+	Total
No Inventory	2085706	2086211	8714335	12886252
Inventory	12536	18315	40259	71110
Total Area	2098242	2104526	8754594	12957362
Area %	16.19%	16.24%	67.56%	100.00%
Inventory %	17.63%	25.76%	56.62%	100.00%
% Total Area Inventoried	0.10%	0.14%	0.31%	0.55%

Inventory Against Elevation (500m Intervals)

	1000-1500	1500-2000	2000-2500	2500-3000	Total
No Inventory	78514	6866511	5567875	373352	12886252
Inventory	158	47863	18124	4965	71110
Total Area	78672	6914374	5585999	378317	12957362
Area %	0.61%	53.36%	43.11%	2.92%	100.00%
Inventory %	0.22%	67.31%	25.49%	6.98%	100.00%
% Total Area Inventoried	0.00%	0.37%	0.14%	0.04%	0.55%

Inventory Against Distance From Perennial Water

	< 500 m	500 - 1000 m	1000 - 1500m	Over 1500m	Total
No Inventory	379899	7523471	3766026	1216856	12886252
Inventory	1972	41534	19971	7633	71110
Total Area	381871	7565005	3785997	1224489	12957362
Area %	2.95%	58.38%	29.22%	9.45%	100.00%
Inventory %	2.77%	58.41%	28.08%	10.73%	100.00%
% Total Area Inventoried	0.02%	0.32%	0.15%	0.06%	0.55%

Inventory Against Gap

	Sage	Deciduous	Agriculture	Grassland	Mtn.Shrub	Total
No Inventory	10521799	722081	19233	35844	1587295	12886252
Inventory	59082	583	0	69	11376	71110
Total Area	10580881	722664	19233	35913	1598671	12957362
Area %	81.66%	5.58%	0.15%	0.28%	12.34%	100.00%
Inventory %	83.09%	0.82%	0.00%	0.10%	16.00%	100.00%
% Total Area Inventoried	0.46%	0.00%	0.00%	0.00%	0.09%	0.55%

Table 3.18 Santa Rosa Study Area Inventory and Site Proportions

Slope in Degrees

	0-5	5-11	11+	Total
No Inventory	2085706	2086211	8714335	12886252
Inventory	12536	18315	40259	71110
Total Area	2098242	2104526	8754594	12957362
Area %	**16.19%**	**16.24%**	67.56%	100.00%
Inventory %	17.63%	25.76%	56.62%	100.00%
% Total Area Inventoried	0.10%	0.14%	0.31%	0.55%
Sites	25852	22371	12081	60304
Site %	**42.87%**	**37.10%**	20.03%	100.00%
Inventoried Areas				
No Sites	2097274	2103298	8753634	12954206
Sites	968	1228	960	3156
Site %	**30.67%**	**38.91%**	30.42%	100.00%
Weight	**1**	**1**	0	

Inventory Against Elevation (500m Intervals)

	1000-1500	1500-2000	2000-2500	2500-3000	Total
No Inventory	78514	6866511	5567875	373352	12886252
Inventory	158	47863	18124	4965	71110
Total Area	78672	6914374	5585999	378317	12957362
Area %	0.61%	**53.36%**	43.11%	2.92%	100.00%
Inventory %	0.22%	67.31%	25.49%	6.98%	100.00%
% Total Area Inventoried	0.00%	0.37%	0.14%	0.04%	0.55%
Sites	15	54313	5398	578	60304
Site %	0.02%	**90.07%**	8.95%	0.96%	100.00%
Inventoried Areas					
No Sites	78672	6911555	5585722	378257	12954206
Sites	0	2819	277	60	3156
Site %	0.00%	**89.32%**	8.78%	1.90%	100.00%
Weight	0	**1**	0	0	

Inventory Against Distance From Perennial Water

	< 500 m	500 - 1000 m	1000 - 1500m	Over 1500m	Total
No Inventory	379899	7523471	3766026	1216856	12886252
Inventory	1972	41534	19971	7633	71110
Total Area	381871	7565005	3785997	1224489	12957362
Area %	**2.95%**	58.38%	29.22%	9.45%	100.00%
Inventory %	2.77%	58.41%	28.08%	10.73%	100.00%
% Total Area Inventoried	0.02%	0.32%	0.15%	0.06%	0.55%
Sites	43662	12832	3354	456	60304
Site %	**72.40%**	21.28%	5.56%	0.76%	100.00%
Inventoried Areas					
No Sites	7562425	3785541	1224399	381841	12954206
Sites	2580	456	90	30	3156
Site %	**81.75%**	14.45%	2.85%	0.95%	100.00%
Weight	**1**	0	0	0	

Inventory Against Gap

	Sage	Deciduous	Agriculture	Grassland	Mtn. Shrub	Total
No Inventory	10521799	722081	19233	35844	1587295	12886252
Inventory	59082	583	0	69	11376	71110
Total Area	10580881	722664	19233	35913	1598671	12957362
Area %	**81.66%**	5.58%	0.15%	0.28%	12.34%	100.00%
Inventory %	83.09%	0.82%	0.00%	0.10%	16.00%	100.00%
% Total Area Inventoried	0.46%	0.00%	0.00%	0.00%	0.09%	0.55%
Sites	58636	137	0	0	1531	60304
Site %	**97.23%**	0.23%	0.00%	0.00%	2.54%	100.00%
Inventoried Areas						
No Sites	10577785	722664	19233	35913	1598611	12954206
Sites	3096	0	0	0	60	3156
Site %	**98.10%**	0.00%	0.00%	0.00%	1.90%	100.00%
Weight	0	0	0	0	0	

Table 3.19 Santa Rosa Study Area Chi Squares

Santa Rosa Elevation

Cells on a 100 m Grid

	Site	Not Site	ROW
1000-1500	0	2	2
1500-2000	28	450	478
2000-2500	3	178	480
2500-3000	1	49	50
COL	32	679	711

Expected Values

	Site	Not Site
1000-1500	0.09	1.91
1500-2000	21.51	456.49
2000-2500	21.60	458.40
2500-3000	2.25	47.75

Cell Chi Values

	Site	Not Site
1000-1500	-0.09	0.09
1500-2000	6.49	-6.49
2000-2500	-18.60	-280.40
2500-3000	-1.25	1.25

Chi-Squares

	Site	Not Site
1000-1500	0.09	0.00
1500-2000	1.96	0.09
2000-2500	16.02	171.52
2500-3000	0.69	0.03

Chi-Square for Table 190.41

Cell Standard Residual

	Site	Not Site
1000-1500	-0.30	0.07
1500-2000	1.40	-0.30
2000-2500	-4.00	-13.10
2500-3000	-0.83	0.18

Cell Variance

	Site	Not Site
1000-1500	0.95	0.04
1500-2000	0.31	0.01
2000-2500	0.31	0.01
2500-3000	0.89	0.04

Adjusted Standard Residual

	Site	Not Site
1000-1500	-0.31	0.31
1500-2000	2.50	-2.50
2000-2500	-7.19	-108.30
2500-3000	-0.88	0.88

Sum -115.49

Santa Rosa Gap

Cells on a 100 m Grid

	Site	Not Site	ROW
Sage	31	560	591
Not Sage	1	120	121
COL	32	680	712

Expected Values

	Site	Not Site
Sage	26.56	564.44
Not Sage	5.44	115.56

Cell Chi Values

	Site	Not Site
Sage	4.44	-4.44
Not Sage	-4.44	4.44

Chi-Squares

	Site	Not Site
Sage	0.74	0.03
Not Sage	3.62	0.17

Chi-Square for Table 4.57

Cell Standard Residual

	Site	Not Site
Sage	0.86	-0.19
Not Sage	-1.90	0.41

Cell Variance

	Site	Not Site
Sage	0.16	0.01
Not Sage	0.79	0.04

Adjusted Standard Residual

	Site	Not Site
Sage	2.14	-2.14
Not Sage	-2.14	2.14

Sum 0.00

Santa Rosa Landform

Cells on a 100 m Grid

	Site	Not Site	ROW
0-5	10	116	126
5-11	12	170	182
11+	10	393	308
COL	32	679	711

Expected Values

	Site	Not Site
0-5	5.67	120.33
5-11	8.19	173.81
11+	13.86	294.14

Cell Chi Values

	Site	Not Site
0-5	4.33	-4.33
5-11	3.81	-3.81
11+	-3.86	98.86

Chi-Squares

	Site	Not Site
0-5	3.30	0.16
5-11	1.77	0.08
11+	1.08	33.23

Chi-Square for Table 39.62

Cell Standard Residual

	Site	Not Site
0-5	1.82	-0.39
5-11	1.33	-0.29
11+	-1.04	5.76

Cell Variance

	Site	Not Site
0-5	0.79	0.04
5-11	0.71	0.03
11+	0.54	0.03

Adjusted Standard Residual

	Site	Not Site
0-5	2.05	-2.05
5-11	1.58	-1.58
11+	-1.41	36.09

Sum 34.68

Santa Rosa H2O

Cells on a 100 m Grid

	Site	Not Site	ROW
<500	26	390	416
500-1000	5	195	200
1000-1500	1	75	616
>1500	0	19	19
COL	32	679	711

Expected Values

	Site	Not Site
<500	18.72	397.28
500-1000	9.00	191.00
1000-1500	27.72	588.28
>1500	0.86	18.14

Cell Chi Values

	Site	Not Site
<500	7.28	-7.28
500-1000	-4.00	4.00
1000-1500	-26.72	-513.28
>1500	-0.86	0.86

Chi-Squares

	Site	Not Site
<500	2.83	0.13
500-1000	1.78	0.08
1000-1500	25.76	447.84
>1500	0.86	0.04

Chi-Square for Table 479.32

Cell Standard Residual

	Site	Not Site
<500	1.68	-0.37
500-1000	-1.33	0.29
1000-1500	-5.08	-21.16
>1500	-0.92	0.20

Cell Variance

	Site	Not Site
<500	0.40	0.02
500-1000	0.69	0.03
1000-1500	0.13	0.01
>1500	0.93	0.04

Adjusted Standard Residual

	Site	Not Site
<500	2.67	-2.67
500-1000	-1.61	1.61
1000-1500	-14.21	-272.89
>1500	-0.96	0.96

Sum -287.10

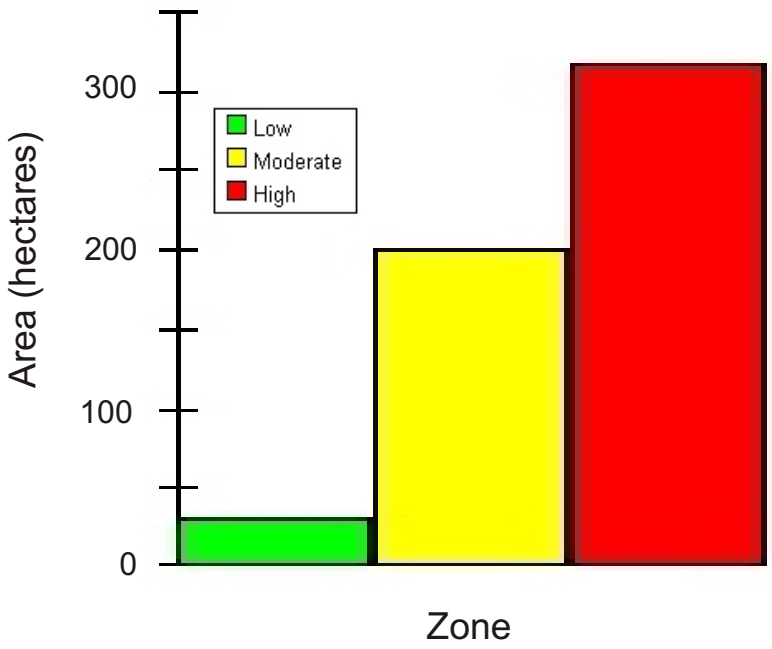
Santa Rosa Study Area
Sensitivity

Redacted - Contains Sensitive Information

Santa Rosa Study Area
Sites and Inventories within Sensitivity Zones

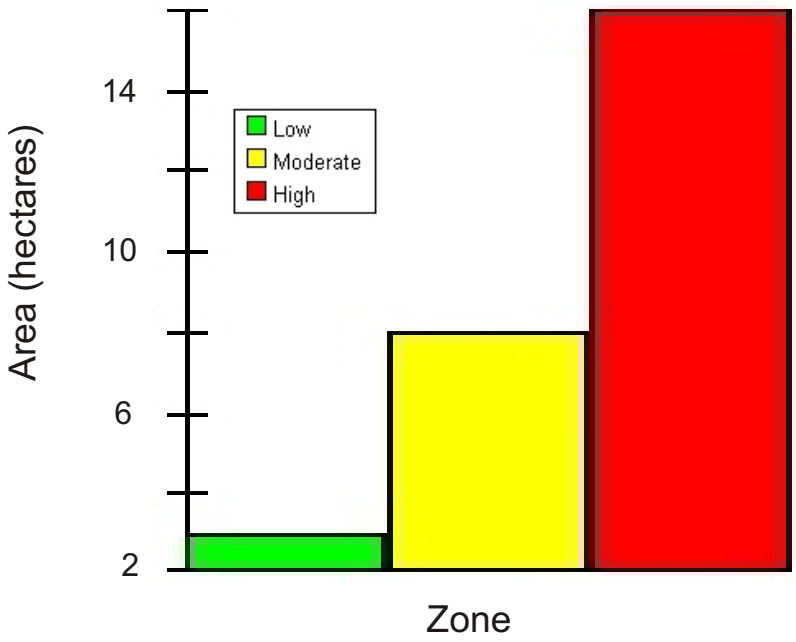
Redacted - Contains Sensitive Information

All Sites
within Santa Rosa Study Area



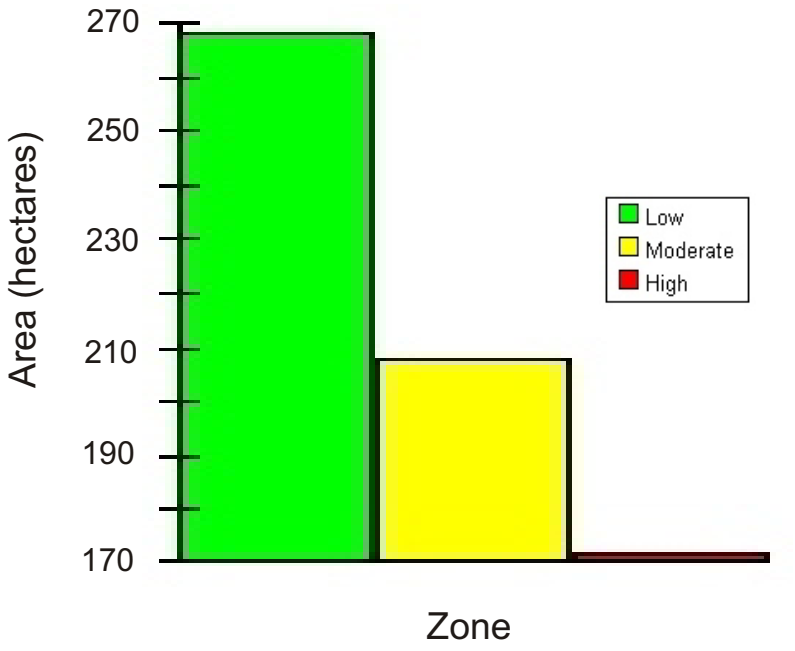
Hectares	Acres	Zone
30	74	Low
200	494	Moderate
318	786	High

Inventoried Sites within Santa Rosa Study Area



Hectares	Acres	Zone
3	7	Low
8	20	Moderate
16	40	High

Inventories within Santa Rosa Study Area



Hectares	Acres	Zone
268	662	Low
208	514	Moderate
172	425	High

Table 3.20 Santa Rosa Study Area Summary Site Density by Sensitivity Zone

	High	Moderate	Low	Total
Model Area (m^2)	175,750,000	532,000,000	505,000,000	1,212,750,000
Model Area (ha)	17,575	53,200	50,500	121,275
Model Area (acres)	43,428	131,457	124,786	299,671
% Model Area	14%	44%	42%	100%
All Sites Area (m^2)	3,180,000	2,000,000	300,000	5,480,000
All Sites Area (ha)	318	200	30	548
All Site Area (acres)	786	494	74	1,354
% Site Area	58%	36%	5%	100%
Site Area : Model Area	0.0181	0.0038	0.0006	0.0045
Model Area : Site Area	**55.27**	**266.00**	**1683.33**	**221.30**

Inventory Area (m^2)	1,720,000	2,080,000	2,680,000	6,480,000
Inventory Area (ha)	172	208	268	648
Inventory Area (acres)	425	514	662	1601
% Inventory Area	26.54%	32.10%	41.36%	100.00%
Inventoried Site Area (m^2)	160,000	80,000	30,000	270,000
Inventory Site Area (ha)	16	8	3	27
Inventory Site Area (acres)	40	20	7	67
% Inventory Site Area	59.26%	29.63%	11.11%	100.00%
Inventoried Site : Inventory	0.0930	0.0385	0.0112	0.0417
Inventory : Inventoried Site	**10.75**	**26.00**	**89.33**	**24.00**

encountered. Density within moderate sensitivity zones increases to 26 to 1, and within low sensitivity zones the ratio of inventory to site is almost 90 to 1.

IV. MODEL TESTING

As a preliminary test of the forecasting model, sample transects were inventoried within the Sierra, West Walker, and O'Neil Basin Study Areas. Within the Sierra and West Walker Study Areas, the sampling universe was stratified by geographic variables to compensate for environmental diversity across the study area. In all study areas, sampling was limited to Forest Service lands and sample quadrats were generally chosen for proximity to roads. Survey methods, details and results are reported in subsequent volumes of the "In the Black" report. Results as they pertain to the model are reported here.

Sierra Study Area

Ten 100 by 1000 meter transects were inventoried within the Sierra Study Area. Three transects fall within areas of low sensitivity, four occur within moderate sensitivity zones, and three within high sensitivity areas (Table 4.1). Five sites were identified during the survey. Two prehistoric sites fall within the high sensitivity zone, one historic site falls within the moderate zone, and one historic and multi-component site fall within the low sensitivity zone. Discounting the two historic properties, most of the newly recorded prehistoric sites occur within the predicted high sensitivity area but site frequencies are too small to build a meaningful statistical test of sensitivity.

West Walker Study Area

Seventeen 100 by 500 meter sample transects were inventoried within the West Walker Study Area, six in each of the high and moderate sensitivity zones, and five within low sensitivity areas. Five prehistoric sites were recorded during the survey, three within high sensitivity zones and one in moderate and low sensitivity areas (Table 4.1). Again, testing results appear encouraging, but site frequencies are too low to infer meaningful sensitivity relationships. It is interesting to note that in both the West Walker and Sierra Study Areas, model testing produced the same number of sites. This is despite the fact

Table 4.1 Model Testing Results

Sierra Study Area

	High	Moderate	Low	Total
Transects (100mx500m)	3	4	3	10
Hectares	30	40	30	100
Acres	74	99	74	247

Sites	High	Moderate	Low	Total
Prehistoric	2			2
Historic		1	1	2
Multi-Component			1	1
Total	2	1	2	5

West Walker Study Area

	High	Moderate	Low	Total
Transects (100mx500m)	6	6	5	17
Hectares	60	60	50	170
Acres	148	148	124	420

Sites	High	Moderate	Low	Total
Prehistoric	2	1	1	4
Historic				
Multi-Component	1			1
Total	3	1	1	5

O'Neil Basin Study Area

	High	Moderate	Low	Total
Transects (100mx500m)	7	7	7	21
Hectares	70	70	70	210
Acres	173	173	173	519

Sites	High	Moderate	Low	Total
Prehistoric	10 (8)	4 (3)	4 (3)	18 (14)
Historic	2			2
Multi-Component	3	1	1	5
Total	15 (8)	5 (3)	5 (3)	25 (14)

(Isolates)

that an additional 700,000 square meters of terrain was inventoried within the West Walker Study Area. Site frequencies seem to validate the low site density within the West Walker Study Area.

O'Neil Basin Study Area

Within the O'Neil Basin Study Area, seven 100 by 500 meter transects were placed in each of the three sensitivity zones (Table 4.1). Twenty-five sites were recorded during this survey of which fourteen are prehistoric isolates and two are historic sites. Disregarding historic sites and isolates, seven of nine sites fall within high and moderate sensitivity zones, while the remaining two occur in low sensitivity areas. More than one-half of the prehistoric sites fall within the high sensitivity zone. One of the sites within the low sensitivity zone is a lithic quarry, a site type not adequately predicted by the current environmental dataset. Site frequencies within the O'Neil Basin Study Area seem to fit the general sensitivity expectations, but again inventoried area is relatively small and the results are not statistically conclusive.

V. SUMMARY AND MANAGEMENT DIRECTIONS

Summary

The In the Black Cultural Resources Planning Model successfully created prehistoric resource sensitivity forecasts based on zones natural environmental variables. It provides a statistically useful indicator for predicting the likelihood of cultural resources on a broad environmental level. Intersecting themes provide a reliable means of identifying probability. The likelihood of encountering cultural resources is highest in areas where multiple predictive evidential themes intersect, while the likelihood of encountering cultural resources lessens as fewer predictive themes are encountered. Table 5.1 shows that as a general rule, sites occur on slopes less than 5 degrees, within 1500 to 2000 meters in elevation, and within 500 meters of water.

Site densities (Inventory Area**:**Site Area ratios) are variable across study units (Table 5.2). Highest densities occur within the Sierra Study Area, but are likely biased by Mount Rose fan and Verdi fan site concentrations. Within the O'Neil Basin Study Area, densities within moderate and low sensitivity areas are similar, probably reflecting a masking effect due to dispersed obsidian source locations over the study area. Site densities within the West Walker Study Area are the lowest of those sampled. Low site density may be an artifact of sampling within specific inventory areas rather than of actual site density. Many surveys, especially those over 20 years old, may have excluded areas from intensive inventory, but report or identify the entire project area as an inventory unit. On the other hand, a 2800 acre fire survey near Bootleg Canyon in 2000, is accurately recorded yet yielded very few sites, so site densities may truly be low within the northern portion of the Bridgeport Ranger District.

One must also bear in mind data quality limitations that went into the creation of the planning models. Natural resource data ranges in accuracy from fairly good (30 meter intervals) to poor (500 meter) accuracy. Thus, the worst common spatial denominator in

Table 5.1 Sensitive Environmental Zones

PREHISTORIC ENVIRONMENTAL THEMES

	SLOPE			
	0-5 degrees	5-11 degrees	11+ degrees	
Sierra Study Area	**X**	**-**	**-**	
	0-3 degrees	*3-6 degrees*	*6-11 degrees*	*11+ degrees*
West Walker Study Area	**X**	**X**	**-**	**-**
	0-5 degrees	5-11 degrees	11+ degrees	
O'Neil Basin Study Area	**X**	**X**	**-**	
Santa Rosa Study Area	**X**	**X**	**-**	

	ELEVATION				
	1000-1500	1500-2000	2000-2500	2500-3000	>3500
Sierra Study Area	**-**	**X**	**-**	**-**	**-**
West Walker Study Area	**-**	**X**	**-**	**-**	**-**
O'Neil Basin Study Area	**-**	**X**	**-**	**-**	**-**
Santa Rosa Study Area	**-**	**X**	**-**	**-**	**-**

	VEGETATION				
	P/J	Conifer	Sage	Riparian	Deciduous
Sierra Study Area	**-**	**-**	**X**	**-**	**-**
West Walker Study Area	**X**	**X**	**-**	**-**	**-**
O'Neil Basin Study Area	**-**	**-**	**X**	**-**	**-**
Santa Rosa Study Area	**-**	**-**	**X**	**-**	**-**

	WATER			
	0-500m	500-1000m	1000-1500m	>1500m
Sierra Study Area	**X**	**-**	**-**	**-**
West Walker Study Area	**X**	**-**	**-**	**-**
O'Neil Basin Study Area	**X**	**-**	**-**	**-**
Santa Rosa Study Area	**X**	**-**	**-**	**-**

Table 5.2 Summary Site Density by Study Area

	Sierra	West Walker	O'Neil	Santa Rosa
Inventory Area (ha)	13475	3308	2509	648
Inventory Area (acres)	33297	8174	6200	1601
Inventoried Site Area (ha)	1400	58	174	27
Inventoried Site Area (acres)	3459	143	430	67
Inventory : Site	9.63	57.03	14.42	24.00
HIGH Inventory:Site	4.21	44.14	8.20	10.75
MODERATE Inventory:Site	17.94	55.51	18.89	26.00
LOW Inventory:Site	46.00	0.00	17.85	89.33

the model is 500 meters. This has a major effect on the boundary between very different vegetation regimes, and related sensitivity zones.

The solution to many limitations lies in utilizing the model frequently. Actively noting inconsistencies (and consistencies) with forecast values will point out areas of poor baseline data, insufficient archaeological knowledge, or both. Both deficiencies can be remedied. Baseline data can be fixed on a local level, and more inventory in poorly-represented settings can be a management goal. From a land use perspective, confirming *low* forecast areas may be the highest priority.

The utility of the model lies in its utilization as a planning tool. One cannot use the GIS data to say an area will be devoid of cultural resources just because it has a *low* value associated with it. For these reasons, In the Black really presents a *planning model* rather than a predictive model. The maps (paper or electronic), which summarize current planning-level knowledge, are thus *forecasts*. The analogy to meteorology is not accidental, for we do not fully understand the system that generated the cultural resources we are attempting to forecast. Just as a forecaster can state that a particular weather pattern is highly likely to yield snow in the Sierra Nevada – without necessarily understanding *why* the pattern occurs – the GBRI model can forecast areas of highest and lowest likelihood of cultural resources. If one thinks of the model and map summary as a forecast, rather than as a fact, then cautiously appropriate planning will likely ensue.

Management Direction

From its inception, the In the Black Cultural Resources Probability Model function was conceived as a pattern recognition tool rather than as an explanatory model of prehistoric behavior. Buffer distances for environmental themes were partly chosen as analogs of prehistoric foraging radii, or in the case of slope, habitable ground, but the results are never synthesized to suggest a behavioral cause. Evidential themes provide only a recognizable landscape layer that can be contrasted against site density patterns.

Cultural resource management carries with it a relatively consistent cost structure. Inventory costs are predictable, with some variation based upon access and expected site density. If site density can be more accurately predicted prior to inventory, then budgets can be more accurately assembled. As the Santa Rosa Study Area data shows, a disproportionate number of surveys were conducted in low sensitivity zones with understandably little found. By modifying transect intervals within predicted low sensitivity zones, inventory and assessment requirements can still be met, with a substantial reduction in overall cost.

Aside from inventory costs, the discovery of potentially eligible National Register properties within a project area and subsequent testing or mitigation adds greatly to project costs. By evaluating site sensitivity as part of the planning process, it might be feasible to simply eliminate or redesign portions of the project where the likelihood of encountering cultural resources is highest.

One of the driving forces behind the In the Black Cultural Resources Probability Model was its utility for fire management. Previously discussed benefits relating to planning are easily transferred to fire related planning. Fuels reduction projects will benefit from advanced cultural resource planning. Additional costs associated with mitigation of sites in high sensitivity zones can be forecast, or those zones can be eliminated from the proposed activity. Intensive cultural resource inventory can be directed towards areas where heritage resources are more likely to occur.

Similar benefits will be realized in fire reclamation planning. Figure 5.1 shows the extent of the Raleigh Heights fire in the Sierra Study Area, known sites, and predicted sensitivity zones. Reclamation efforts within moderate and low sensitivity zones would likely have little impact on cultural resources, with relatively low associated costs. On the other hand, unsurveyed areas within high sensitivity zones appear likely to contain cultural resources and evaluation/mitigation of those resources could add considerable cost to the project.

Sierra Study Area
Raleigh Heights Fire and Sensitvity

Redacted - Contains Sensitive Information

Benefits relating directly to fire incidents may also be realized as a result of this project. Providing site and inventory plots as well as sensitivity zones to cultural resource professionals on the incident team could reduce inadvertent destruction of cultural resources. Knowing the location of sites and areas where cultural resources are likely to be encountered could be factored into decisions regarding placement of fire lines, fire camps, and staging areas.

Maintenance of the site and sensitivity database becomes a key issue in the utility of the model. Since the model is based upon pattern recognition, subsequent inventories and new site data may provide subtle, or in some cases dramatic changes to the distributional patterns. Certain classes within an environmental theme may have been inadequately sampled during previous investigations, or sites poorly reported. Newly acquired data may effectively increase both inventoried strata and drive results towards more or less predictable distributions.

A simple tally sheet that summarizes the areal coverage in each model zone, and the resulting site density can be created for each new inventory. Every new inventory and resource should be held in GIS, verified, and flagged as not having contributed to the current generation of the model. Periodically, the model maintainers need to review new information and decide what effort should be put in to model revisions. This could be as simple as just adding the new data to the forecast maps without statistical re-analysis, or as comprehensive as running entirely new tallies and contrasts.

In summary, the In the Black Cultural Resources Probability Model is a successful attempt at forecasting the probability of encountering cultural resources across the landscape. The utility and limitations for the planning model have been discussed above, but the model's utility is worth reiterating again. The appropriate use of the model relates to:

- Long range planning.
    - High probability relates to greatest likely overall expense.
    - Low probability equates with fewer resources, lower overall expense.
    - If fewer sites are encountered, then testing, mitigation costs are reduced.
    - Low probability does not mean sites will not be present and does not obviate the need for fieldwork.
- Accurate models can be used to increase the efficiency and effectiveness of fieldwork.
- As the model is verified further, cultural resource managers may want to examine different levels of investigation within low probability areas.
- Models and forecasts articulate current state of knowledge. They should be periodically updated and reevaluated to assure their accuracy.

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