

# **MODELING THE VOLCANIC TABLELANDS**

**GIS PREDICTIVE MODELING FOR  
SITE LOCATIONS**

**Along**

**OHV ROUTES of TRAVEL**

**By**

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## Study Overview

➤ **This presentation provides the results of a GIS modeling effort undertaken by the BLM, Bishop Field Office on the Volcanic Tableland, Owens Valley, California.**

➤ **The Model was Originally Created to address Climber Conflicts and then Adapted to OHV Routes of Travel.**



## Study Overview

### Model Development

- Utilizing existing empirical and theoretical data the model defines probability zones to identify hunter-gatherer use areas.
- The model was originally tested against new inventory data from targeted surveys in identified high probability zones.

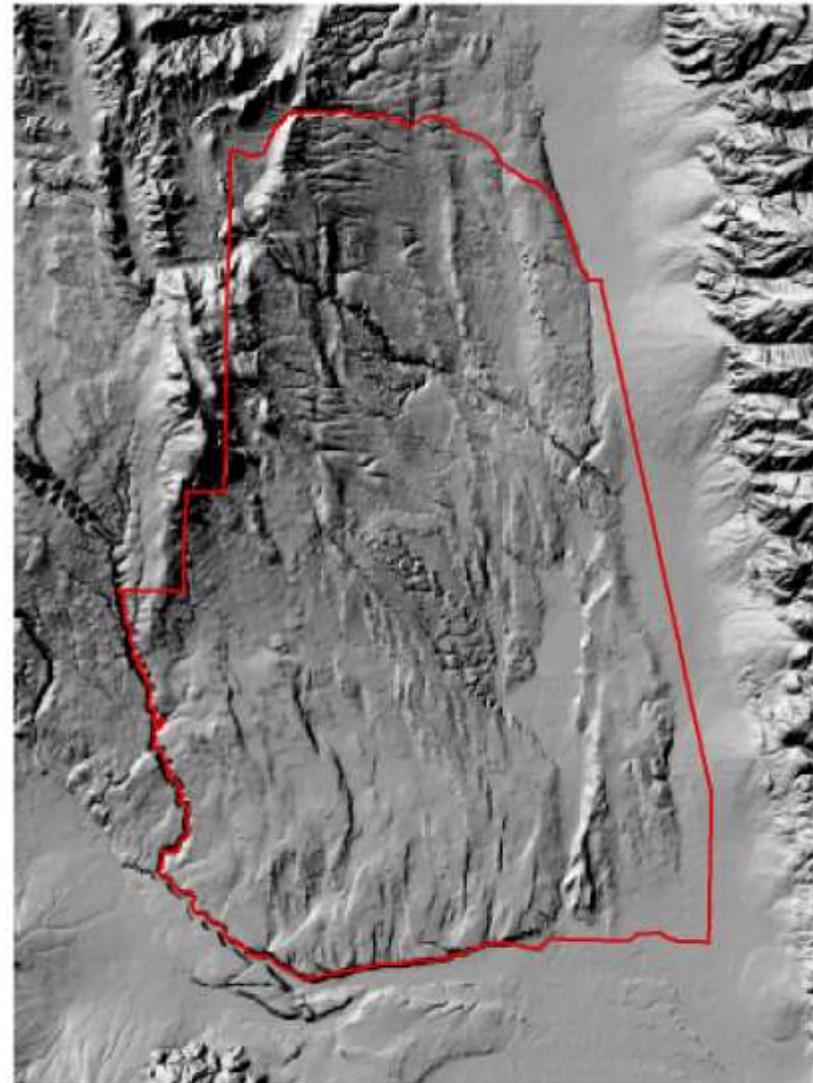
# STUDY ORGANIZATIONAL FLOW CHART



# STUDY CATCHMENT AREA

## VOLCANIC TABLELANDS (100,515 Acres)

- Rhyolitic Ash Flow
- ~738,000 Years Old
- ~150 m Thick
- N/S Trending Fault Block System 1-2 km Apart
- Fluvially Reworked
- Shadscale Scrub Habitat Today. Early Holocene Juniper Stands
- 10,000 Years of Hunter-Gatherer Use
- 281 Previously Recorded Archaeological Sites



Legend

 Study Catchment Area (100,515 acres)

Value

High : 254

Low : 0



 4 2 0 4 Kilometers

# Study Area

## The Volcanic Tablelands

Volcanic Tablelands Overview from South



Fish Slough ACEC: A Rare Desert Marshland



View To Western Tablelands  
Sierra Nevada Mountains



Southern Tablelands Chalk Bluff  
Owens River



Yellow Jacket National Register Site



# WORLD CLASS BOULDERING

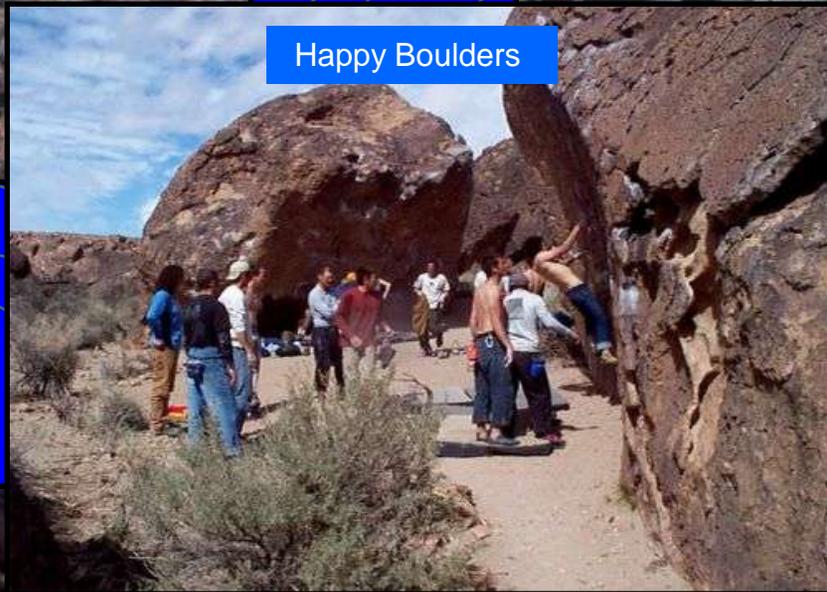
Fault Systems Sought By Boulderers



Happy Boulders Fault



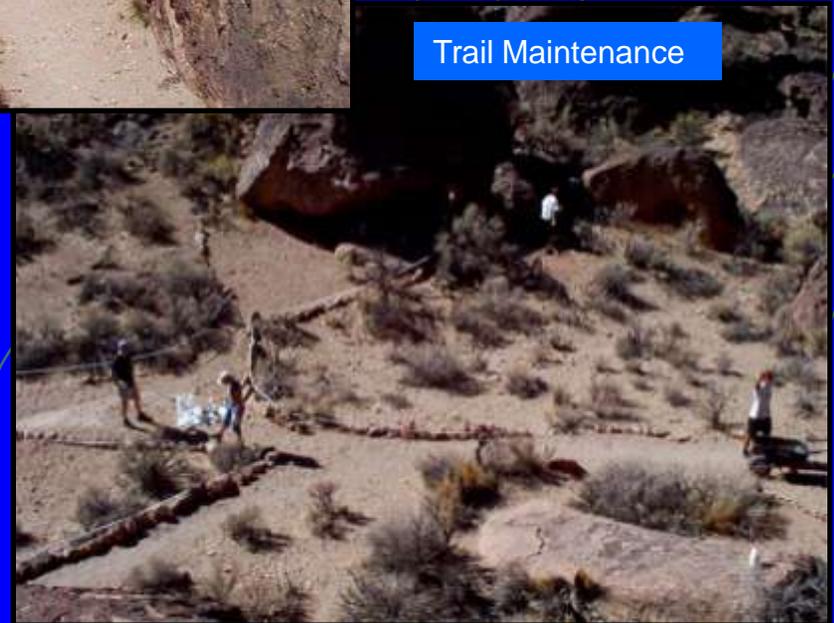
Happy Boulders



Happy Boulders



Trail Maintenance

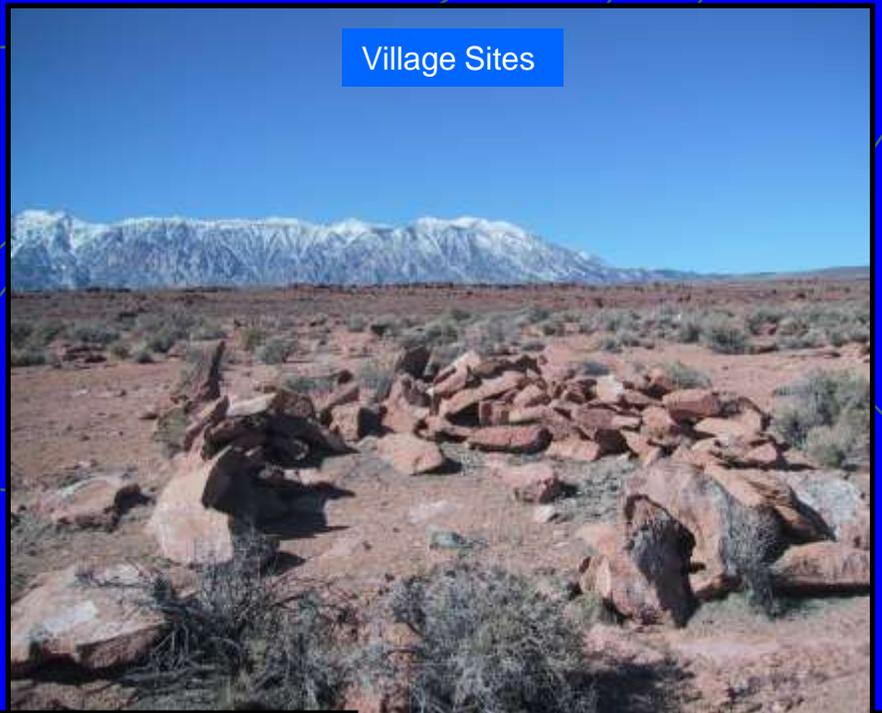


# ARCHAEOLOGICAL VALUES

Petroglyph Sites



Village Sites



Shelters and Caves



Milling Areas



# Research/Study Questions

## ➤ HUNTER GATHERER BEHAVIOR

- Land Use Patterns
- Subsistence Strategies
- Adaptive Strategies
- Territoriality
- Cultural Change

## ➤ PREVIOUS RESEARCH

- Basgall and Giambastiani 1995; Bureau of Land Management (1978); Enfields 1960s; Giambastiani 1996, 1997, 2004; Meighan 1955; Nelson 1996, 1999; Nissen 1982
- Paleoenvironmental Studies

## ➤ FORAGING THEORY

# GIS Model Flow Chart

Assess Data Needs Based on Management Issues and Study Questions

Define Study & Catchment Area

Data Organization

Cultural Data  
Previous Research  
Surveys & Sites  
Historic Features

Environmental Data  
Landform/Geology  
Paleoclimate/Hydrology  
Slope

Develop GIS Modeling Strategies  
(Theoretical and/or Empirical)

Cultural Use Areas  
Distance to P Water  
Distance to I Water  
Distance to Faults

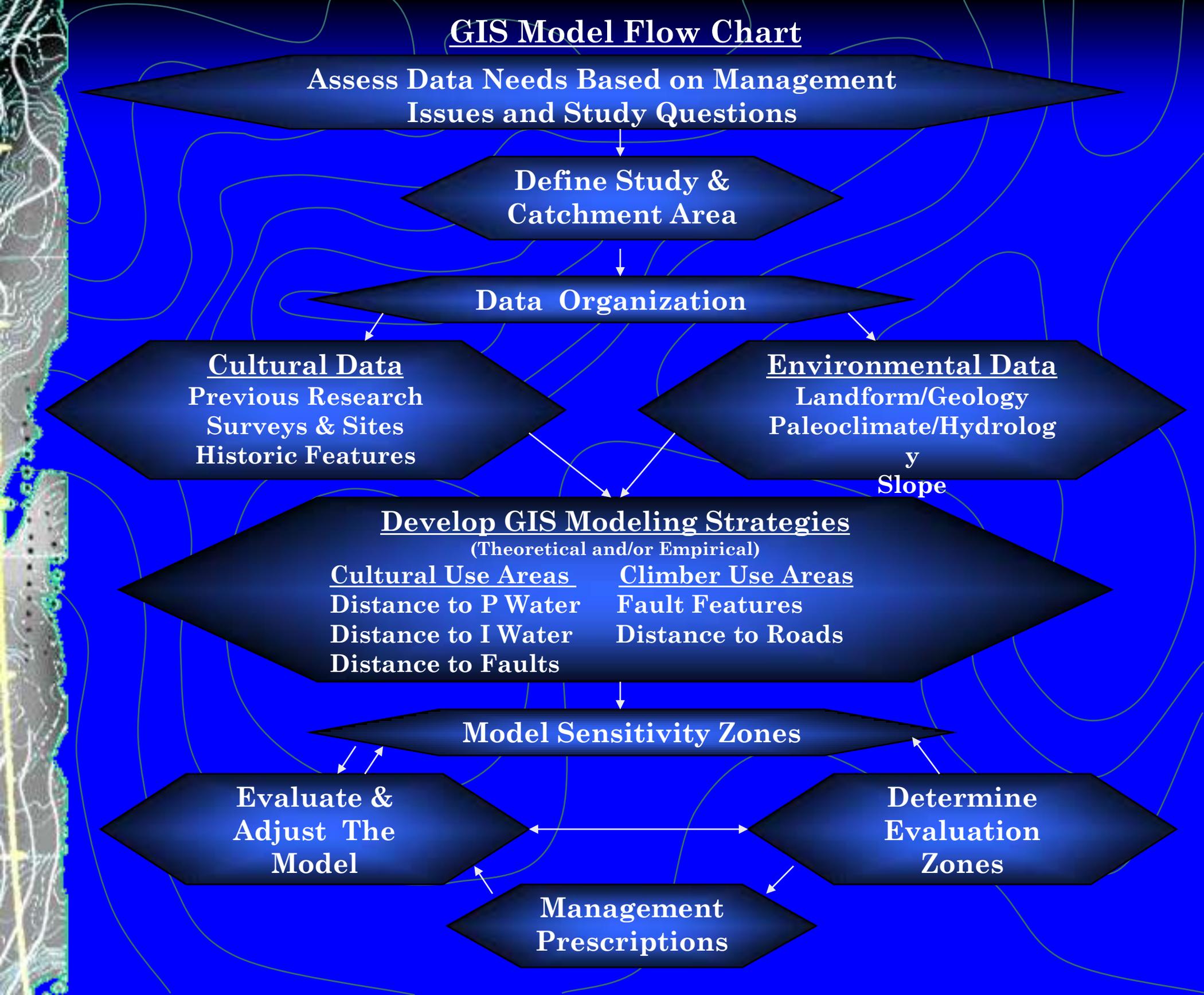
Climber Use Areas  
Fault Features  
Distance to Roads

Model Sensitivity Zones

Evaluate & Adjust The Model

Determine Evaluation Zones

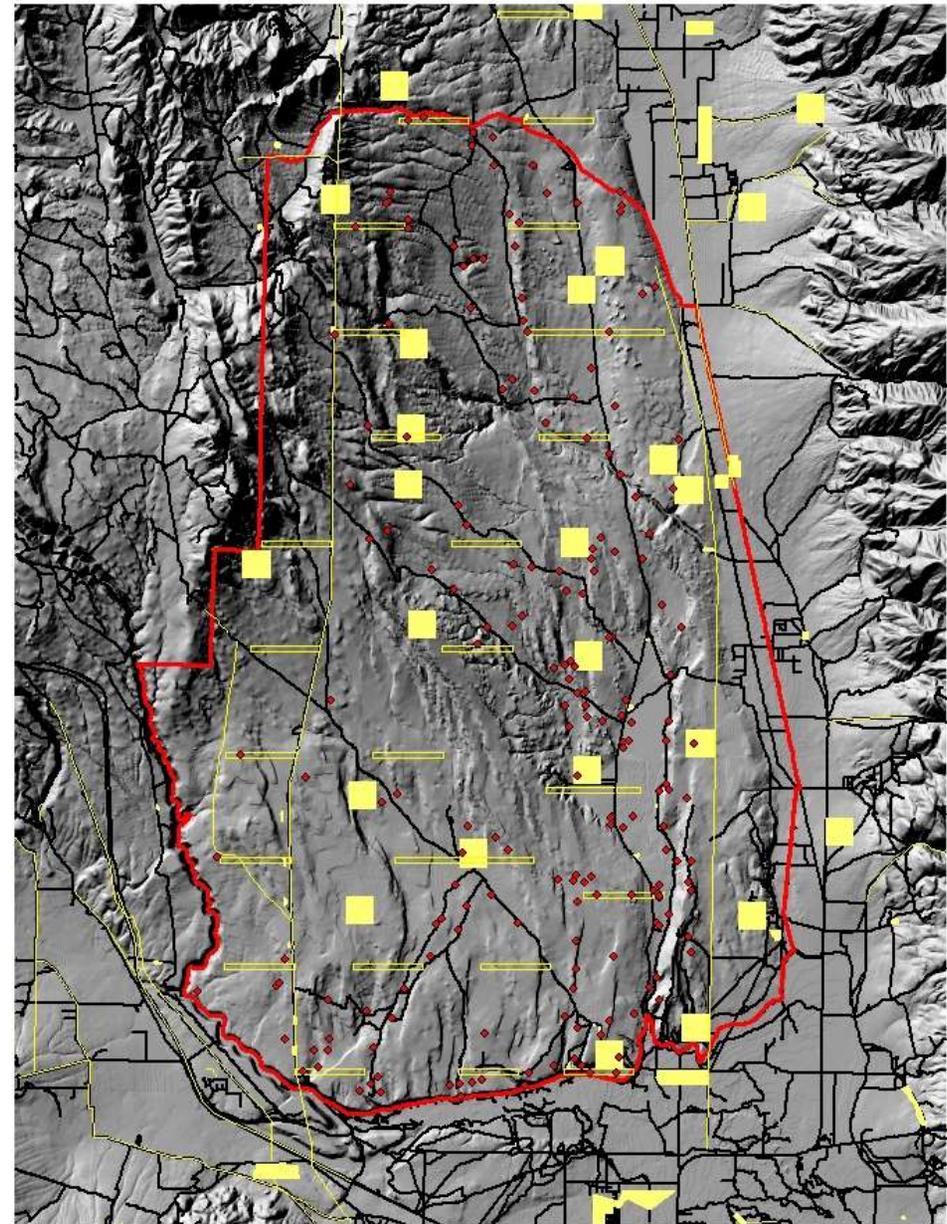
Management Prescriptions



# Data Organization for Catchment Area

## CULTURAL RESOURCE DATA

- Catchment Area 100,515 Acres
- Previous Research
  - Surveys (4043 Acres = 4% of the Catchment Area)
  - Sites Recorded (281 = 0.69 Sites km<sup>2</sup>)
  - BLM (1978) 1.2 Sites km<sup>2</sup> in random sample within Study Area
  - Meighan (1955) 3.2 Sites km<sup>2</sup> in Fish Slough
  - Giambastiani (1996, 1997, 2004) 2.2 Sites km<sup>2</sup> on Tableland Proper



Legend

◆ Sites

— Roads

■ Surveys

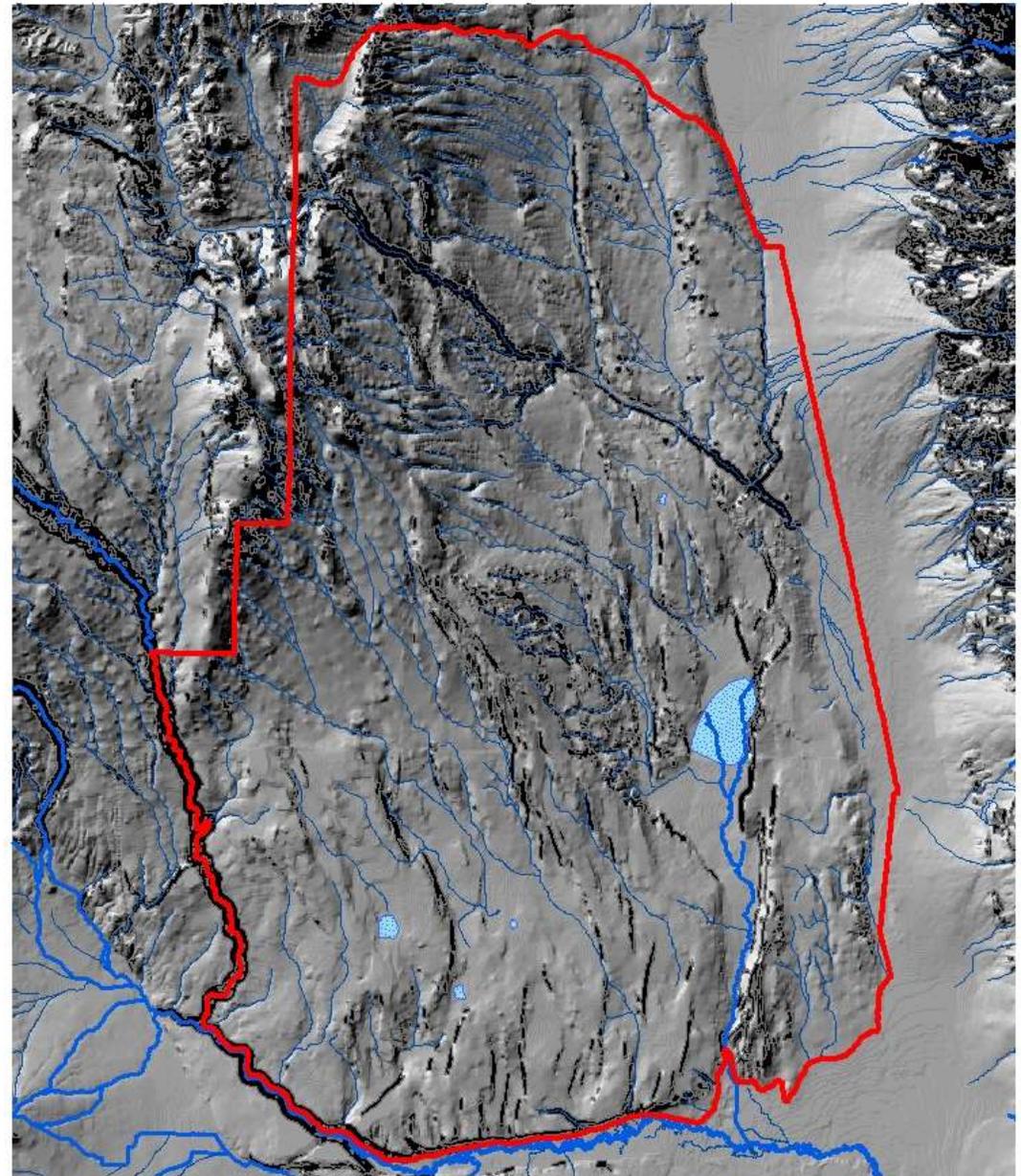
▭ Study Area

0 1.5 3 6 9 12 Kilometers

# Data Organization

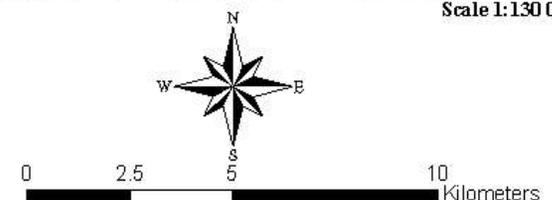
## NATURAL RESOURCE DATA

- **Landform/Geology**
  - Based on a 10 m Digital Elevation Model
- **Fault Zones**
  - Fault Zones Predicted from Slope Variation within a 100 m area.
  - Hillshade used for Visual Verification
- **Hydrology**
  - Perennial Water
  - Intermittent Water
- **Paleoenvironmental Data**



### Legend

-  Study Area
-  Fault Zones
-  Intermittent Water
-  Perennial Water
-  Basins/Playas



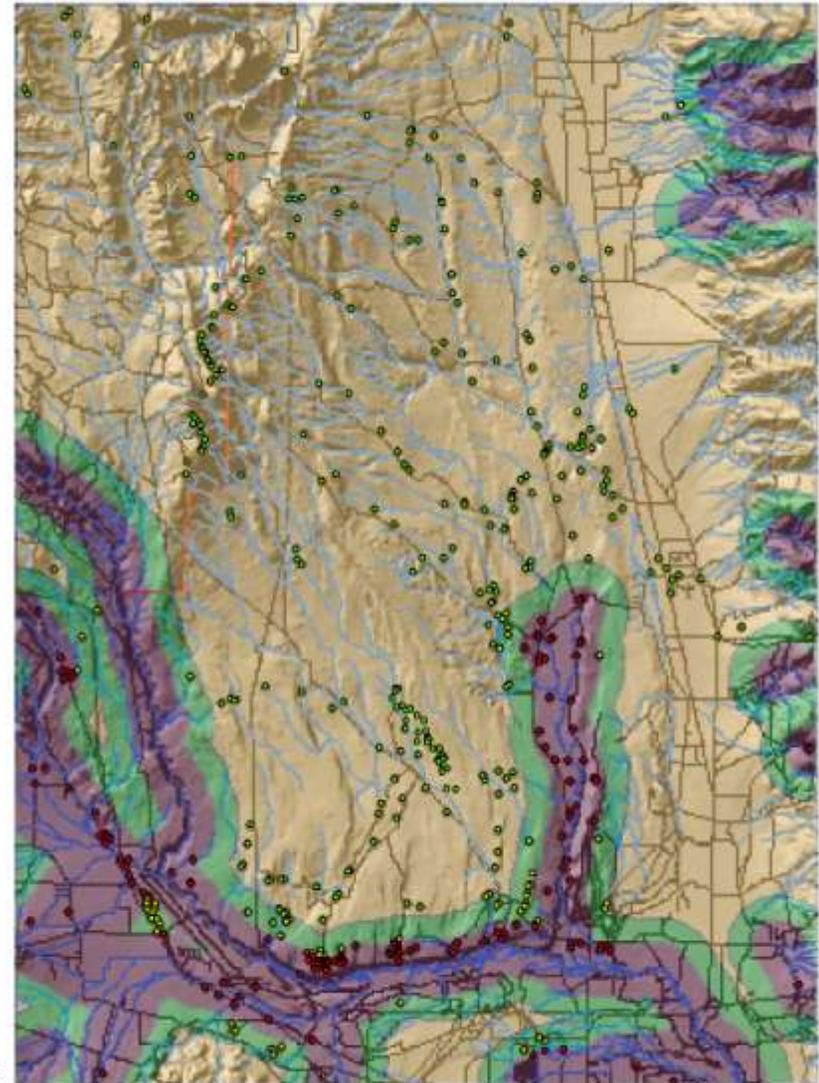
# GIS Modeling Cultural Buffer Zones

## ➤ Distance to Perennial Water

➤ Zone 1 -  $\leq \frac{1}{2}$  Mile  
(28% of the Sites)

➤ Zone 2 -  $\frac{1}{2}$ -1 Mile  
(5% of the Sites)

➤ Zone 3 -  $> 1$  Mile  
(67% of the Sites)



Legend

Study Catchment Area (100,515 ares)

PZONE

Zone 1

Zone 2

Zone 3

DISTANCEP

• Zone 1- 28%

• Zone 2 - 5%

• Zone 3 - 67%

— Perennial Water

— Intermittent Water



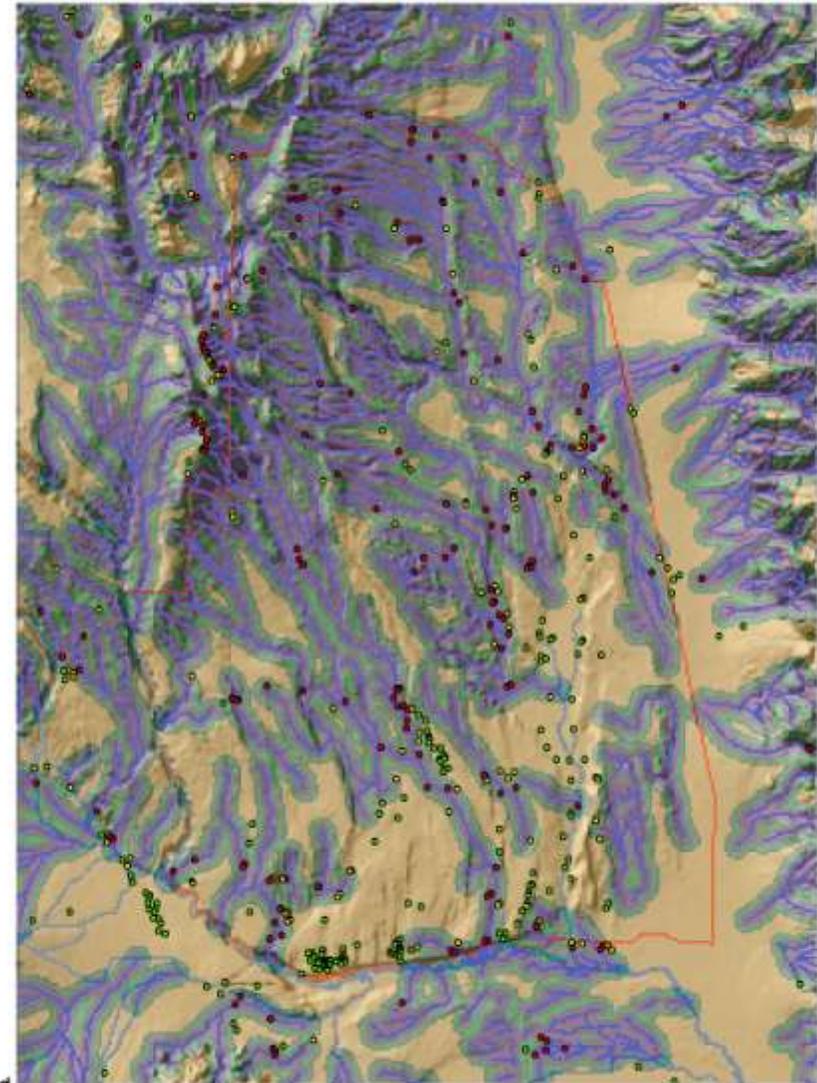
# GIS Modeling Cultural Buffer Zones

## ➤ Distance to Intermittent Water

➤ Zone 1 -  $\leq 1/8$  Mile  
(37% of the Sites)

➤ Zone 2 -  $1/8 - 1/2$  Mile  
(22% of the Sites)

➤ Zone 3 -  $> 1/2$  Mile  
(41% of the Sites)



### Legend

 Study Catchment Area (100,515 ares)

### IZONE

 Zone 1

 Zone 2

 Zone 3

### DISTANCEI

 Zone 1 - 37%

 Zone 2 - 22%

 Zone 3 - 41%

 Intermittent Water

 Perennial Water



# GIS Modeling Cultural Sensitivity Zones

## Probability of Significant Site Occurrence

### ➤ Zone 1 – High Probability

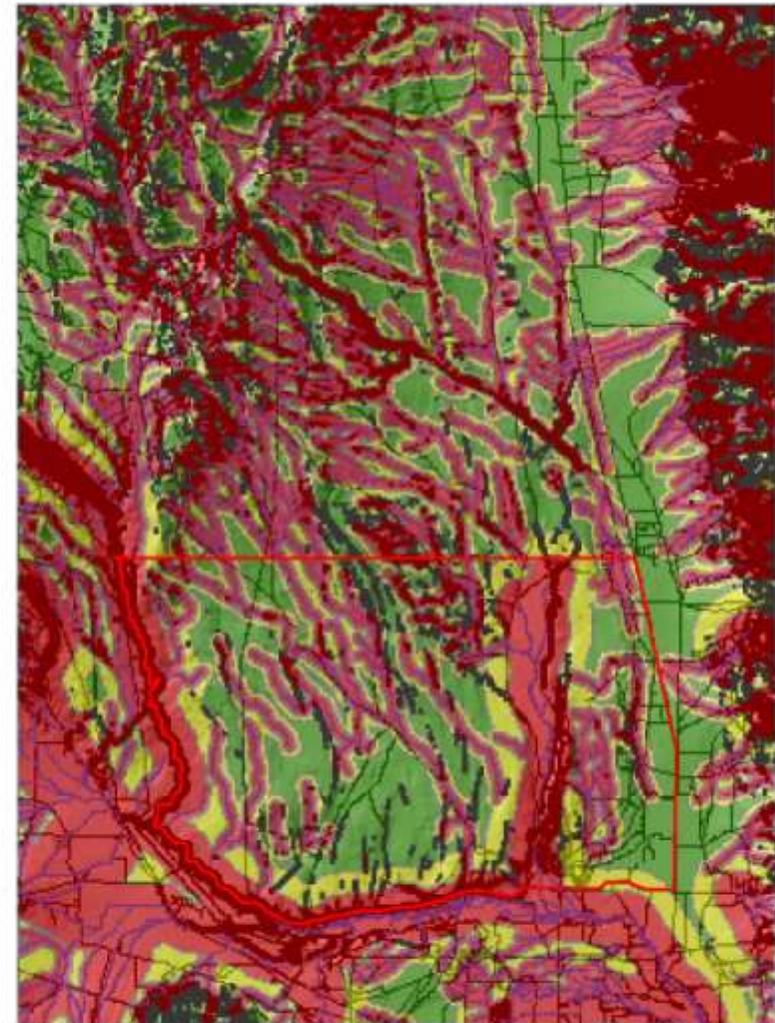
- On Fault
- Within ½ Mile of P Water
- Within 1/8 Mile of I Water

### ➤ Zone 2 – Moderate Probability

- Not on Fault
- Within ½ - 1 mile of P Water
- Within 1/8 – ¼ of I Water

### ➤ Zone 3 – Low Probability

- Not On Fault
- > 1 Mile from P Water
- > ¼ Mile from I Water



Legend

Study Area (51,967 acres)

**CSZONE**

- 1 - High Probability
- 2 - Moderate Probability
- 3 - Low Probability

Fault Zones

Perennial Water

Intermittent Water



4 2 0 4 Kilometers

# GIS Modeling

## Results of Field Inventory

- 40 Sites Recorded within the Southern Tablelands Chalk Bluff Targeted Areas (1.2 km<sup>2</sup>)

33.3 Sites km<sup>2</sup>

- 95% Zone 1
- 5% Zone 2

- 24 Sites Recorded within Northern Tablelands Targeted Areas (2.8 km<sup>2</sup>)

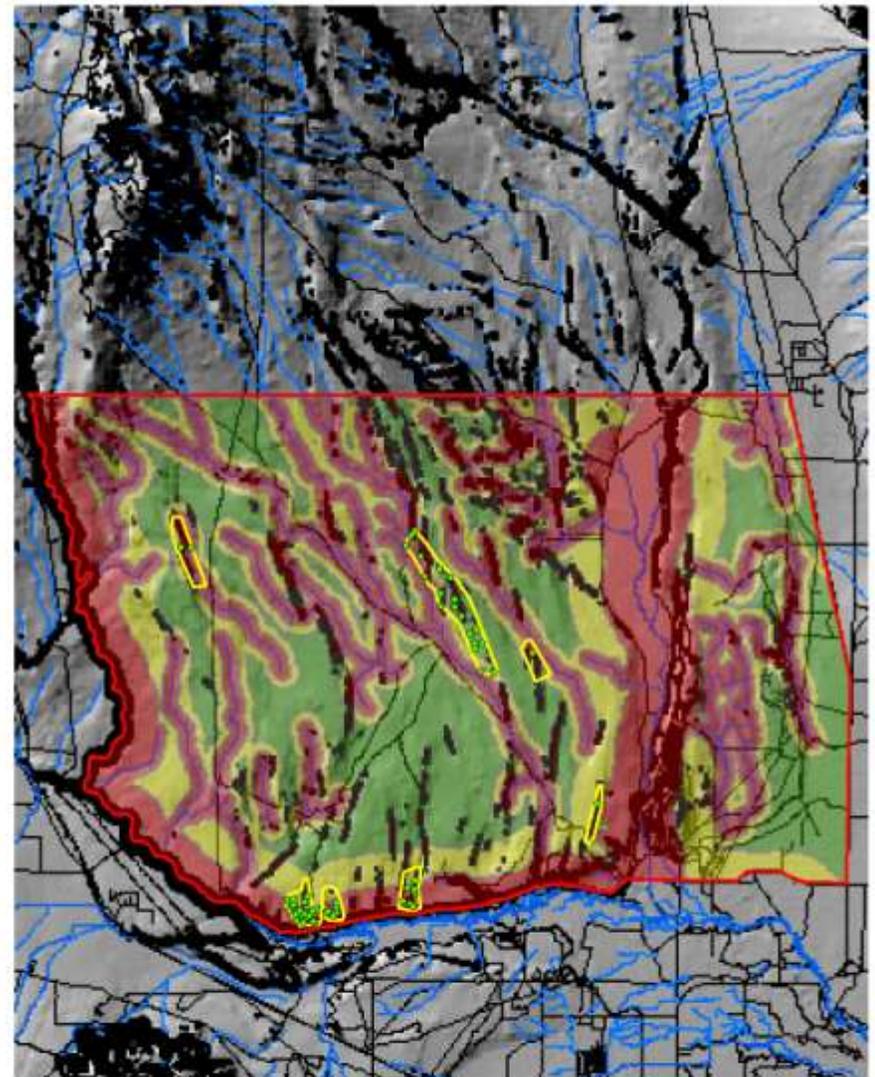
8.6 Sites km<sup>2</sup>

- 71% Zone 1
- 4% Zone 2
- 25% Zone 3

- 64 Sites Total (4 km<sup>2</sup>)

- 16 Sites km<sup>2</sup>
- 86% Zone 1
- 5% Zone 2
- 9% Zone 3

(\*Note Only Point Data is Shown)



Legend

- Sites Recorded
- Study Area (51,967 acres)
- Survey Areas (1003 Acres)
- Intermittent Water
- Perennial Water

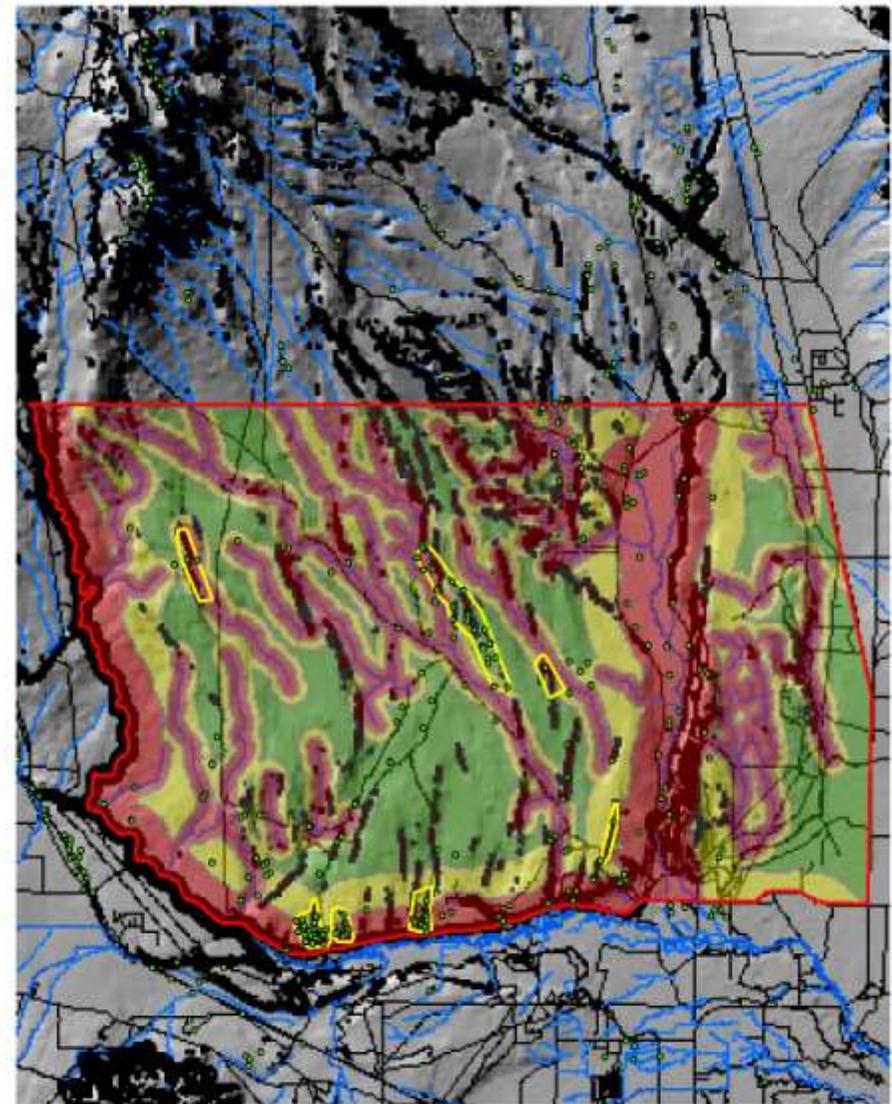


# GIS Modeling Results Within The Study Area

## 212 Sites Within Study Area

- 150 (71%) Sites within Zone 1
- 40 (19%) Sites within Zone 2
- 22 (10%) Sites within Zone 3

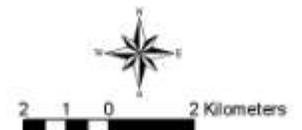
High Confidence Level in the Models Predictive Power



### Legend

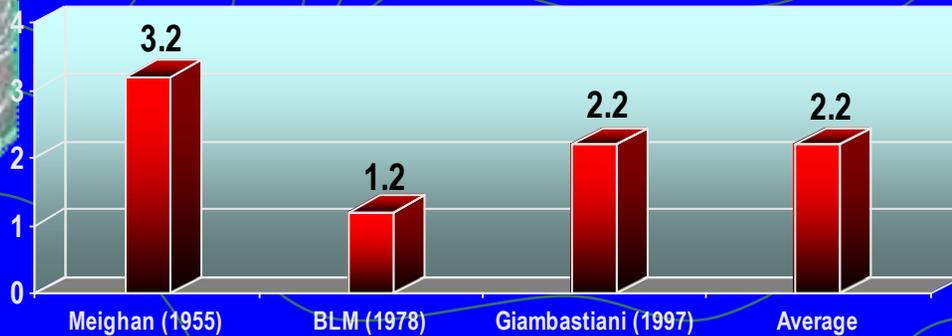
- All Sites Recorded
- Study Area (51,967 acres)
- Survey Areas (1003 Acres)

- Intermittent Water
- Perennial Water

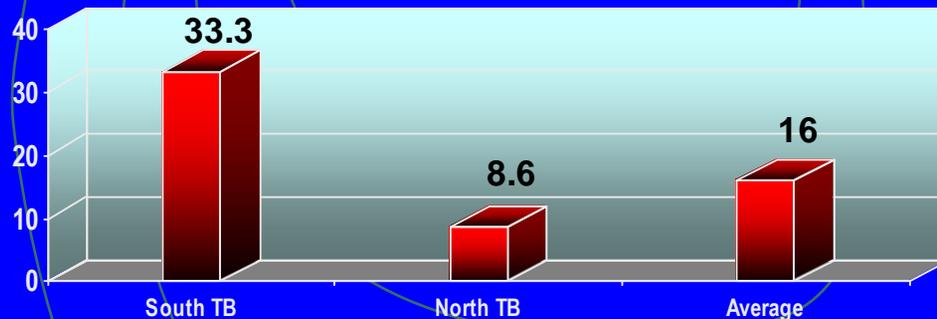


# Conclusions from Original Study

Previous Research  
Sites km2



2001/2002 Targeted Surveys  
Sites km2

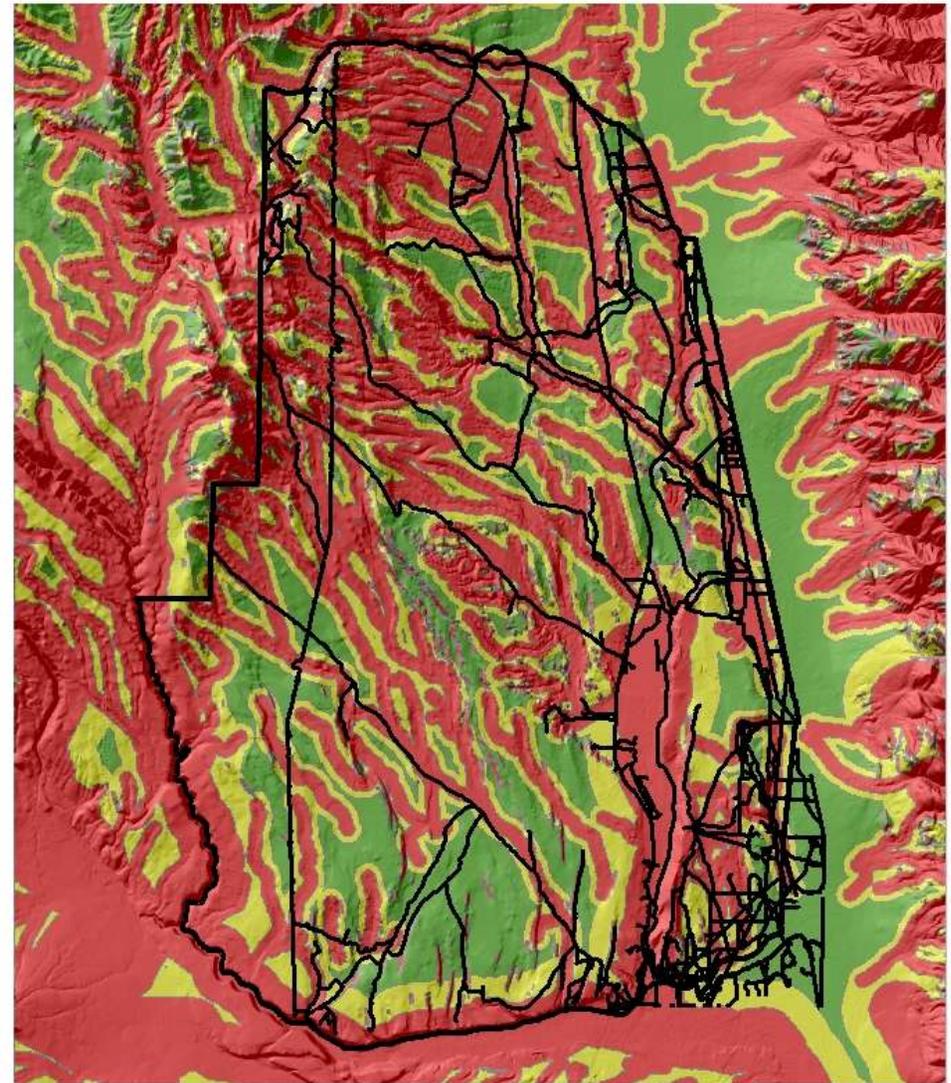


- The GIS Model developed for the Tablelands is robust. Fully 90% of all sites recorded are found within the highest sensitivity zones (Zone 1 [71%] and Zone 2 [19%])
- As graphically represented by the charts, the targeted inventory within the modeled sensitivity zones revealed a significantly higher site frequency than indicated by previous research
- Based on the analyses, there is a high level of confidence that the model predicts areas with significant cultural resource values
- The model provides an important tool for making informed management decisions based upon the best data

# Applicability to OHV Routes of Travel

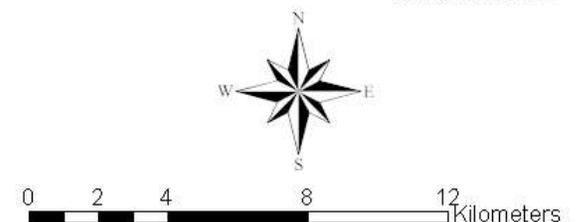
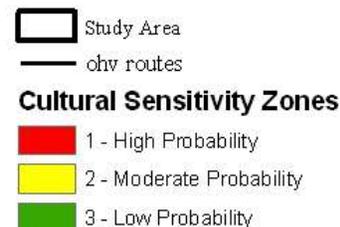
## Study Goals

- To Complete a 20% Sample of 568 Kilometers (353 Miles) with Equal Zonal Distribution
- Sample Area: 116 Linear Kilometers x 50 Meters
- 1433 Acres of Inventory
- Giambastiani's (2004) Methodology and Site Typology (10 items within a 25x25m area)



LEGEND

Scale: 1: 150 000

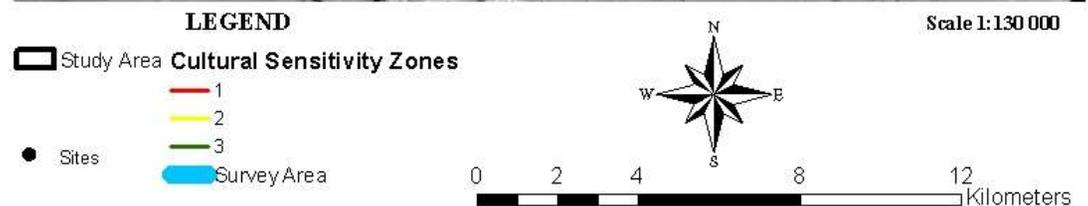
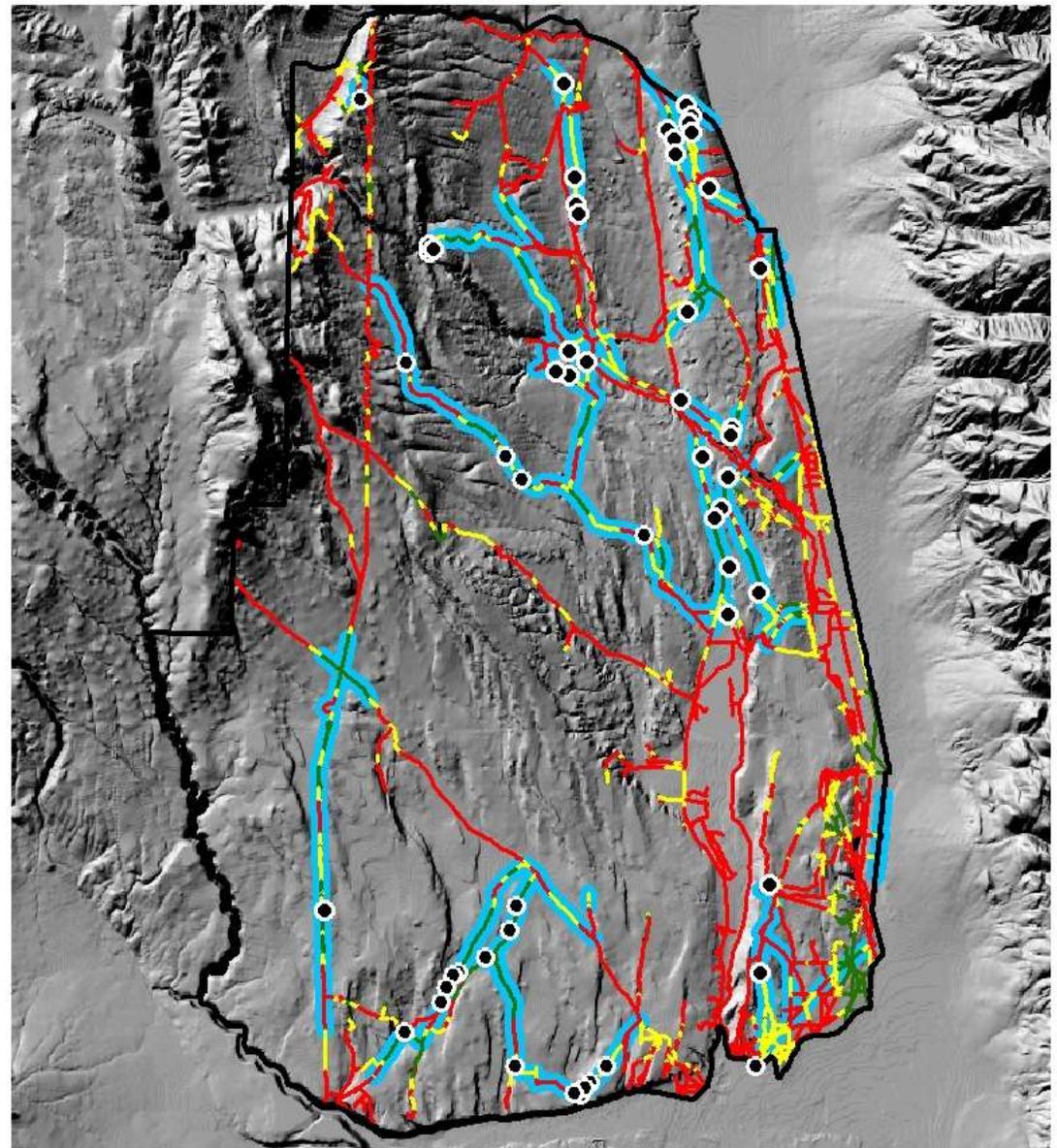


# Giambastiani's (2004) Site Types

- **Type 1**: Low to moderate-density scatters of flaked stone debris with few or no ground stone artifacts.
- **Type 2**: Moderate to heavy accumulations of flaked and ground stone debris, often with bedrock milling slicks or mortars, but lacking both middens and stacked rock constructions (e.g., house rings or threshing floors).
- **Type 3**: Moderate to heavy concentrations of flaked and ground stone debris with middens, rock constructions, or both.
- **Type 4**: Isolated milling loci, with portable or bedrock facilities and ground stone debris, containing few or no flaked stone artifacts.
- **Type 5**: Isolated, non-milling rock constructions (house rings, blinds, walls) with or without low-density scatters of flaked stone debris.

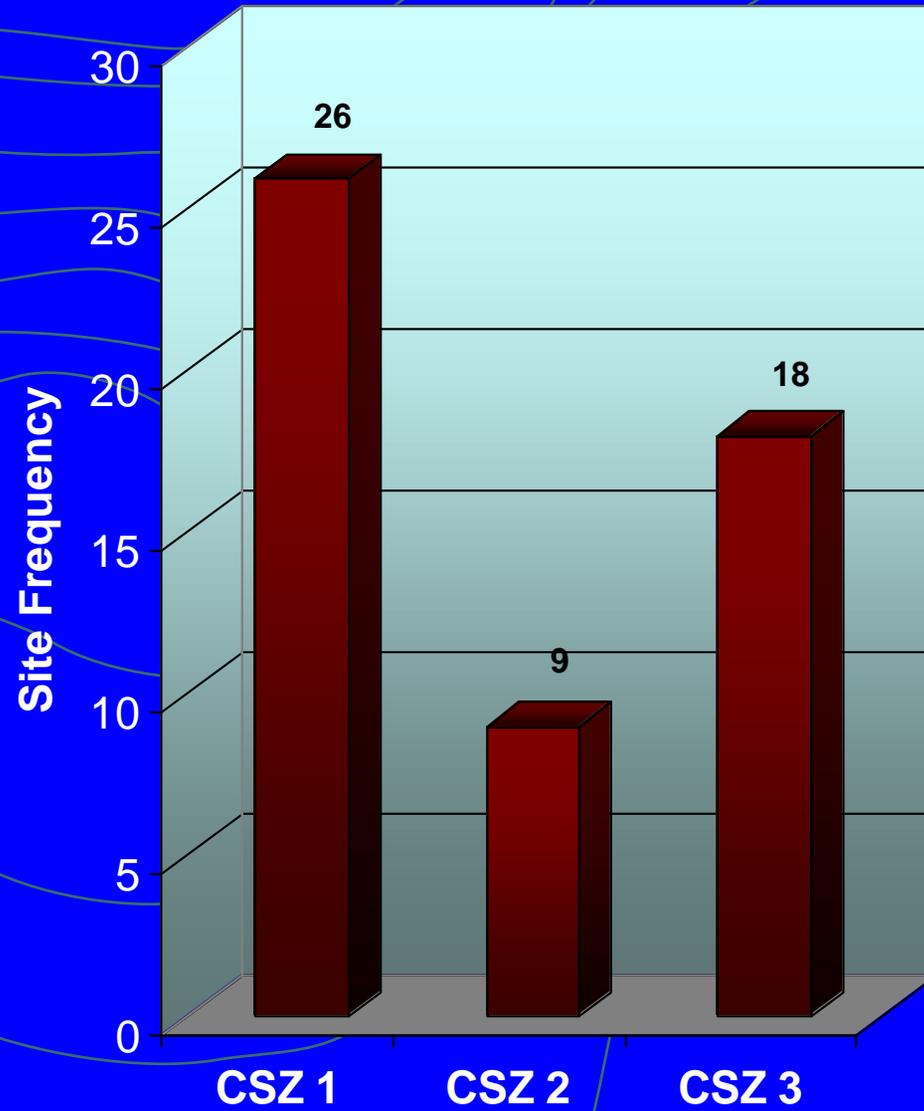
# Results

- 1433 Acres (5.8 km<sup>2</sup>)
- 477 Acres per Zone (1.9 km<sup>2</sup>)
- 53 Sites Recorded
- 9.1 Sites per km<sup>2</sup>
- 79 Isolated Finds



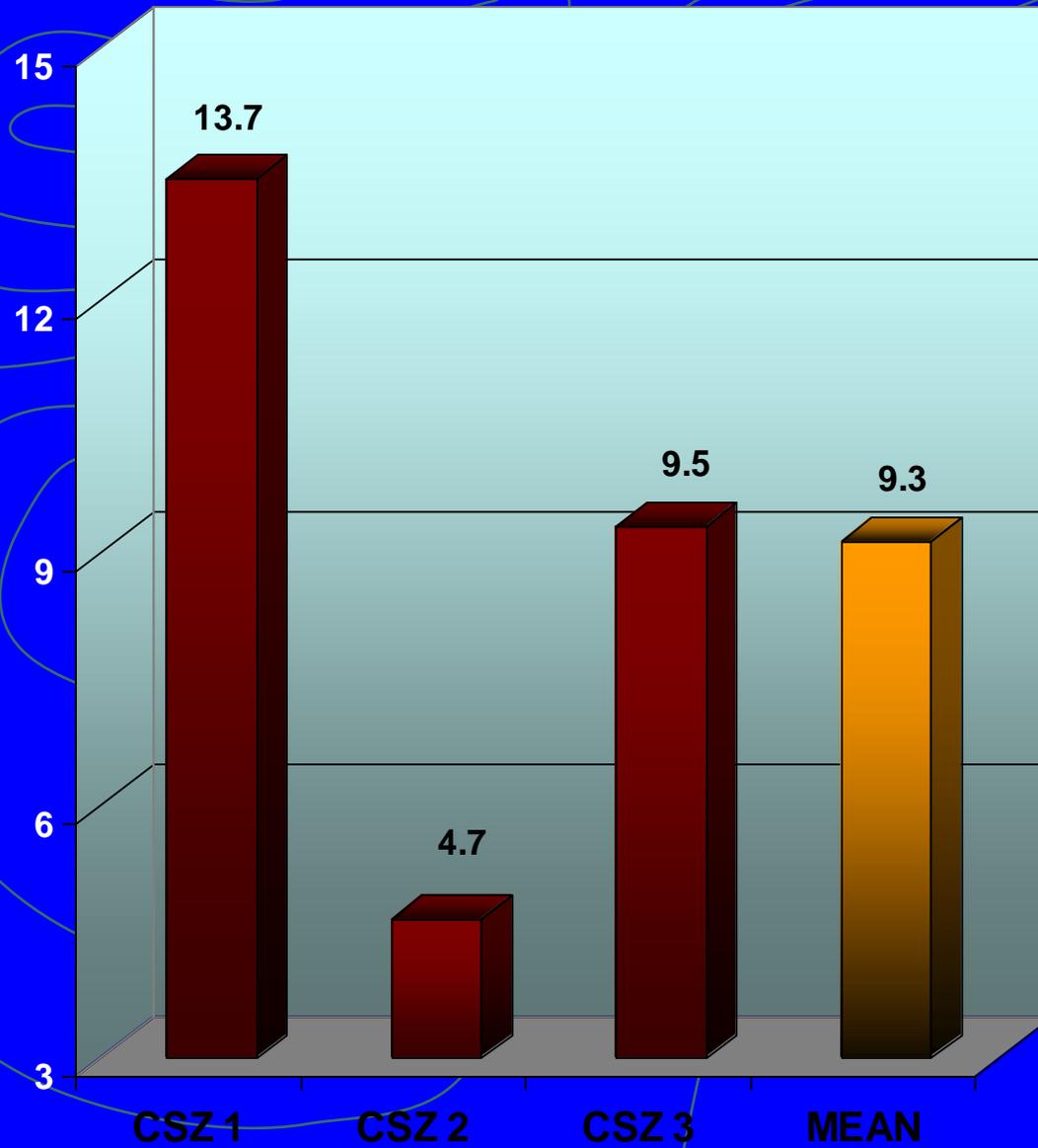
# Results

## SITES PER CULTURAL SENSITIVITY ZONE



# Results

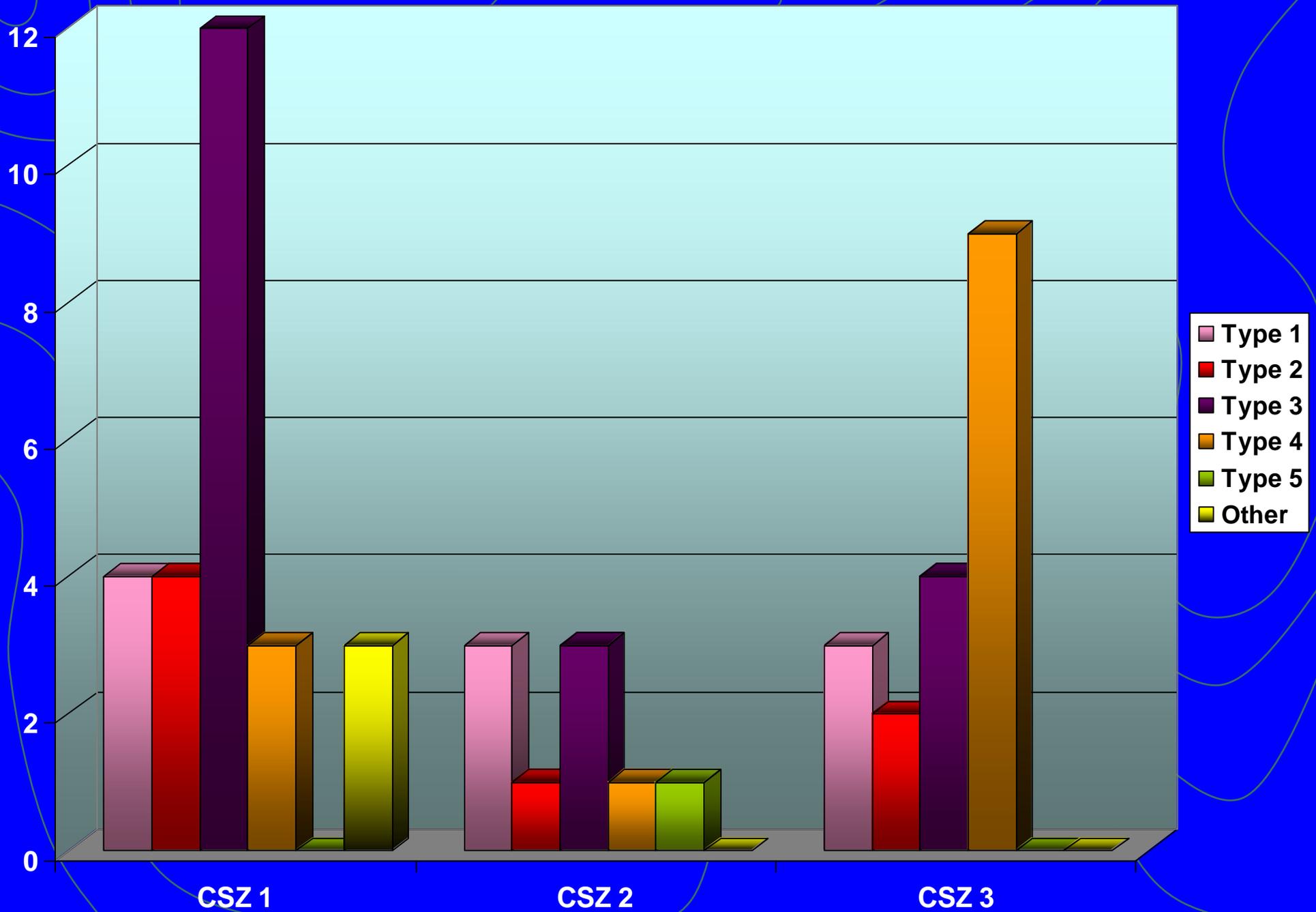
NUMBER OF SITES PER SQUARE KILOMETER  
BY ZONE



# Results

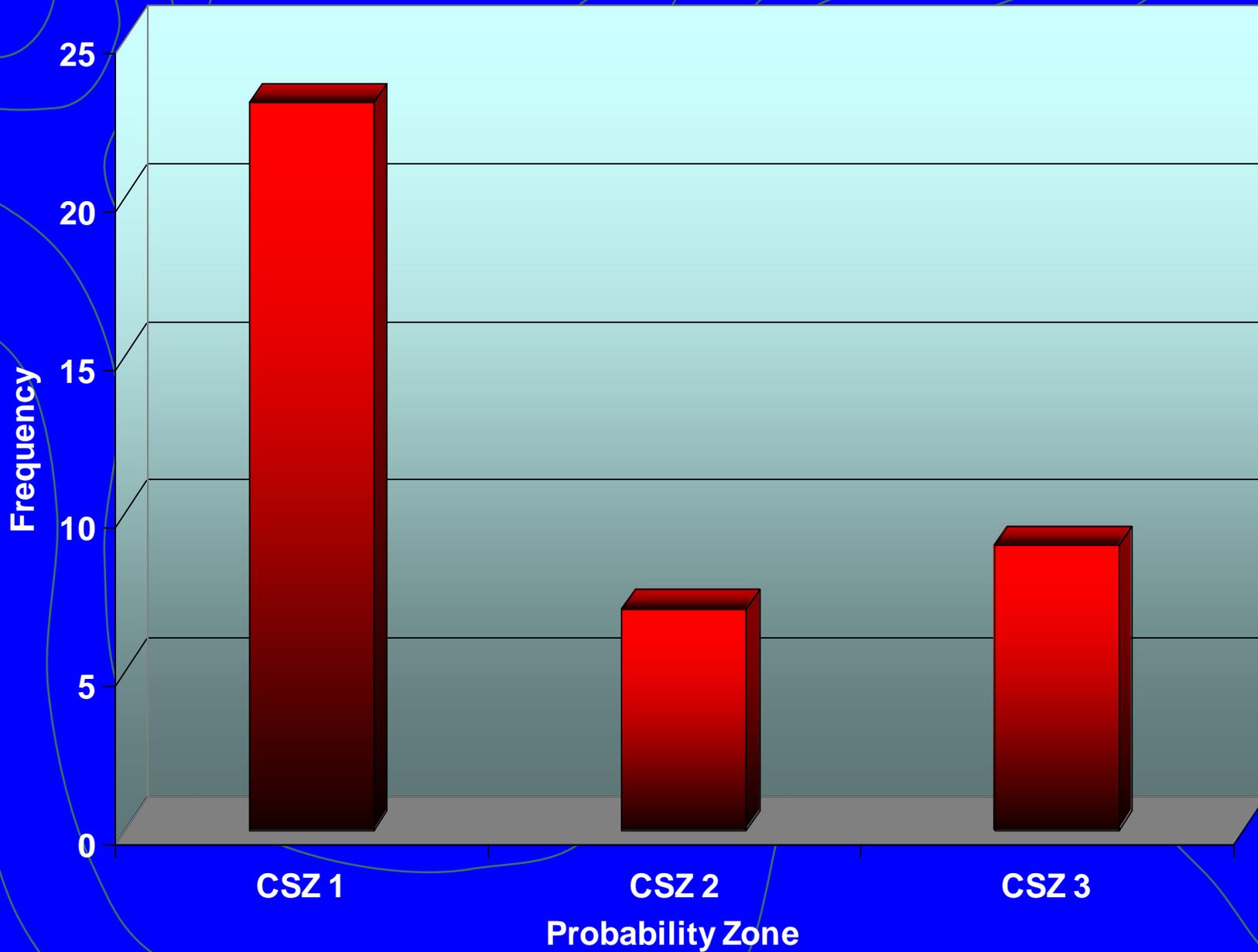
## Giambastiani Site Typologies (2004)

TYPE OF SITE PER CULTURAL SENSITIVITY ZONE



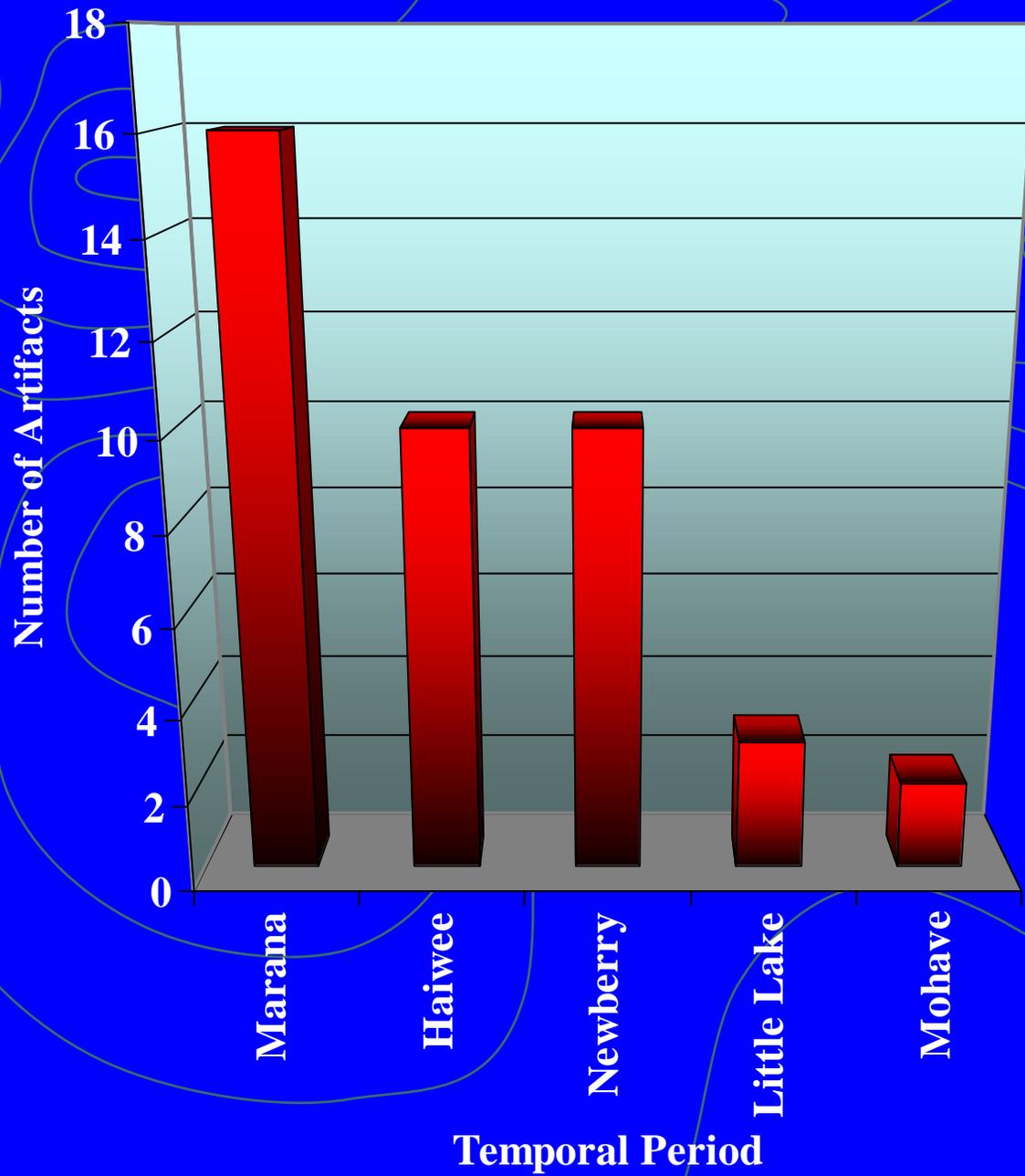
# Results

Site Frequencies per Zone  
Excluding Type 4 and 5 Isolated Features



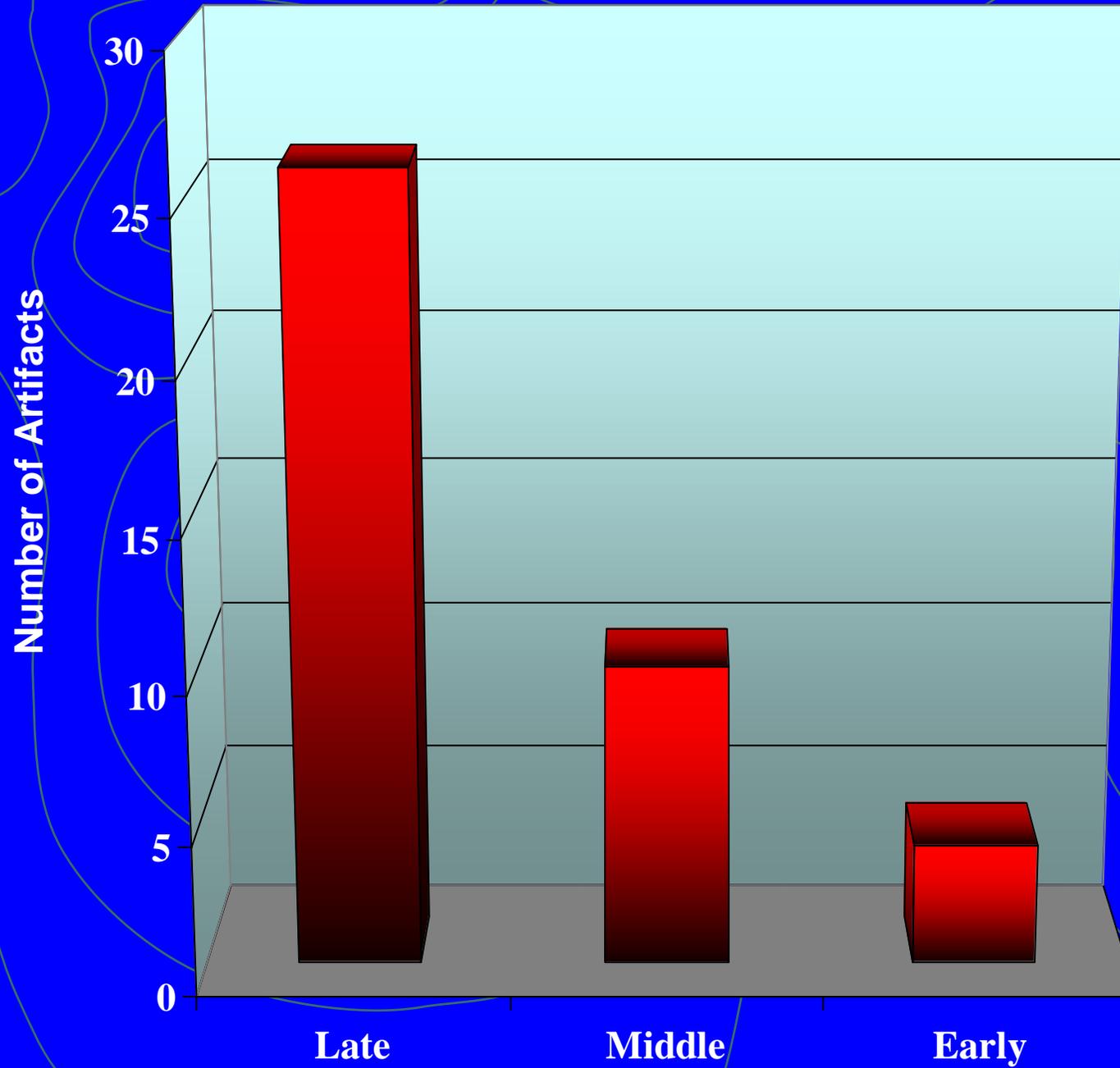
# Results

## Chronology



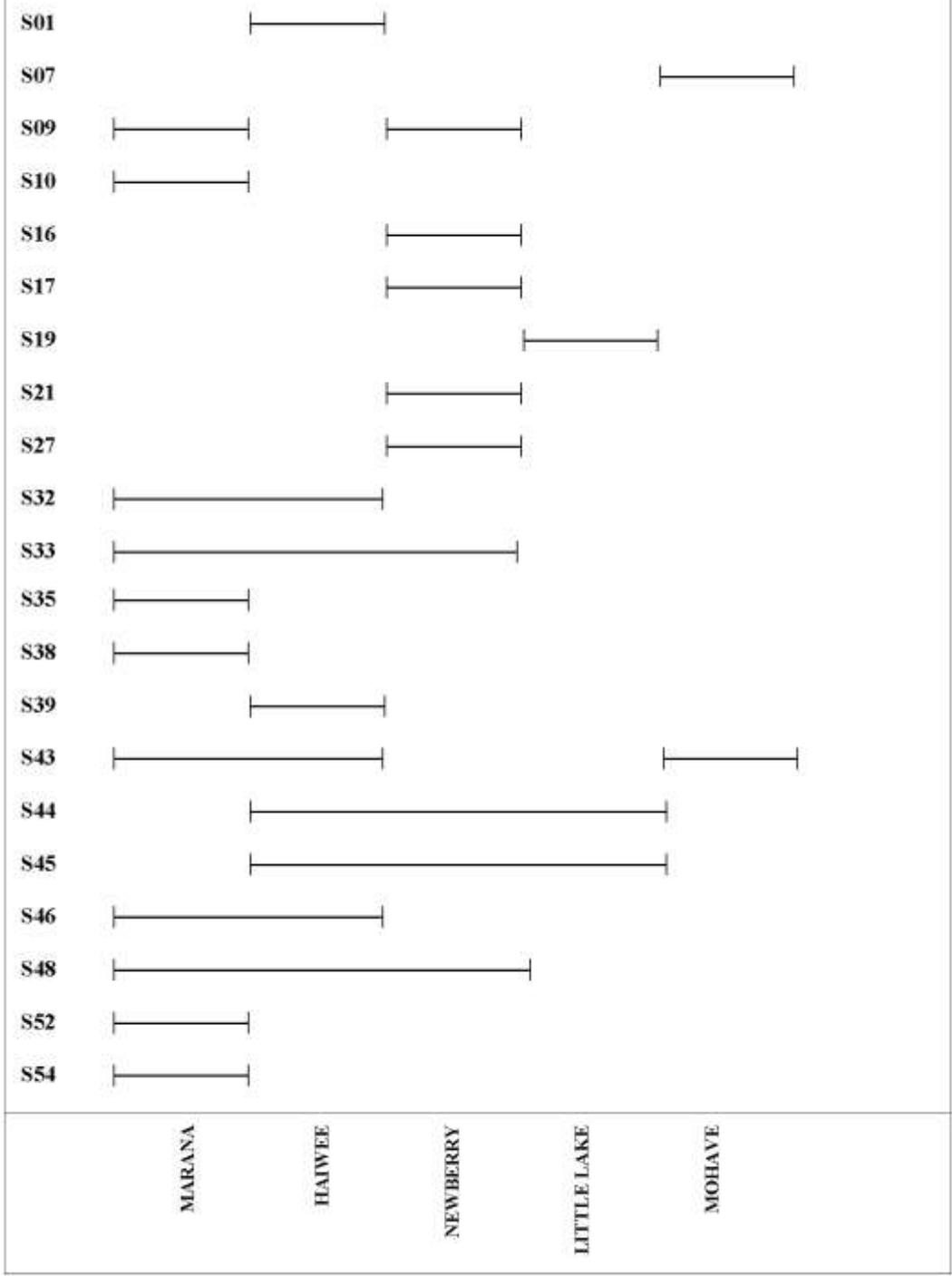
# Results

## Chronology: Archaic Periods



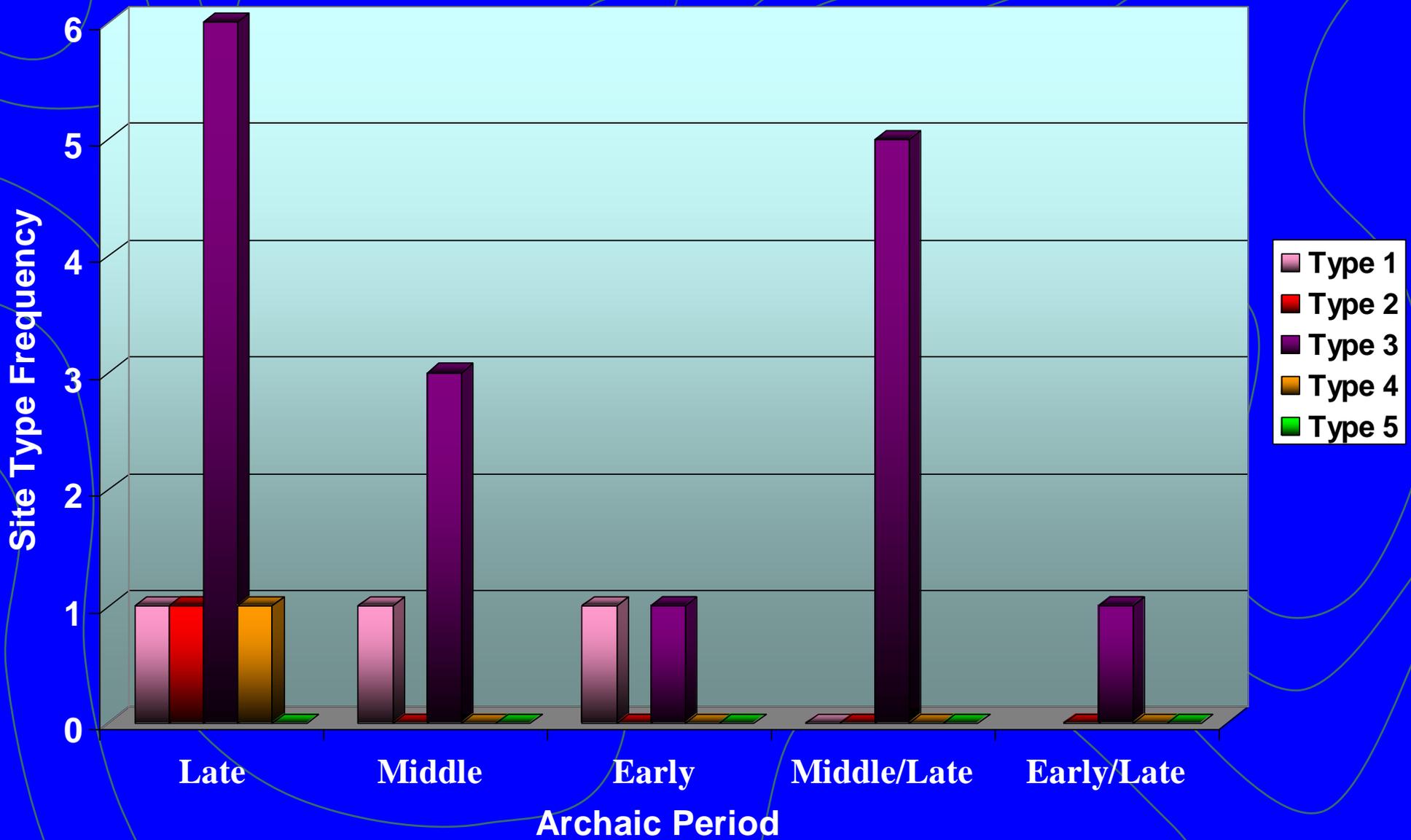


### Temporal Distribution of Sites Based on Temporally Diagnostic Artifacts



# Results

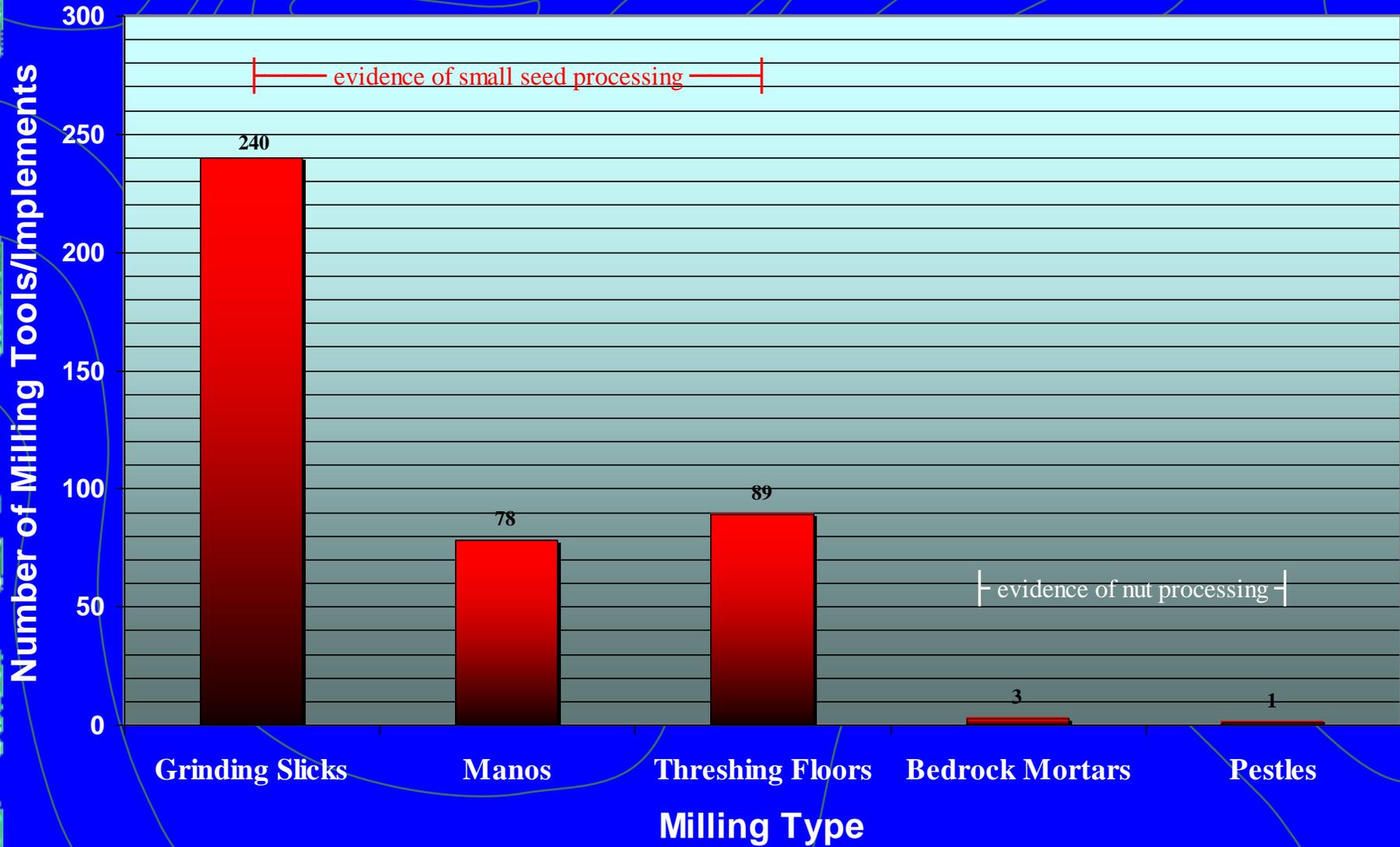
## Temporal Distribution by Site Type



# Results

Milling Present: Sites = 83%; Isolates = 28%

## Milling Assemblage



# Conclusions

- **The Tablelands GIS Predictive Model remains Robust through 4 Field Seasons of testing**
- **Overall Site Densities are Significantly Higher than Predicted by Random Sampling**  
**9.1 Sites km<sup>2</sup> vs 2.2 Sites km<sup>2</sup>**
- **Site Densities in the High Probability Zone Ranges from 13.7 (N Tableland) to 33.3 (S Tableland)**
- **Re-evaluate Random Sampling: A Question Of Stratification, Sampling Error or Both?**
- **Understanding Paleoecology is Critical for Modeling Forager Behavior on the Tableland**

# The Tableland As A “Marginal” Habitat

**Basgall and Giambastiani (1995:4-5)**

“Recognizing that the concept of “marginal environment” is a tricky one...it appears that resource variability and, very probably, levels of resource productivity, are more limited on the Volcanic Tablelands than any numbering of surrounding areas”.

“However “marginal” the Volcanic Tablelands were during the middle and late Holocene relative to surrounding areas, it appears that since at least ca. 3300 B.P. that there was at least moderate residential use...(264)”.

**Giambastiani (2004:470)**

“...the Tableland comprises a sort of “marginal” environment relative to the neighboring Owens Valley”.

# Is The Tableland A “Marginal” Habitat?

- **This Study Suggests Not!**
- **104 identified useable species occur in the Eastern Sierran region.**
  - **66 occur on the Tableland (63%):**
    - **36+ Dryland Species**
    - **30 Wetland Species**
- **Of the useable dryland species found in the region 82% occur on the Tableland.**
- **On a seasonal basis (April-June), during optimal climates, the Tableland would have provided one of the best gathering habitats in the Eastern Sierran region.**
- **Village Site Locations (Type 3 Sites) support this hypothesis and indicate occupation during wetter intervals, concomitant with years of high resource production.**

# Conclusion



- **We Need to Re-Examine the notion of “Marginality”**
  - **Seasonality is Key**
- **Paleoenvironment: Understanding past environments, not how they appear today, is paramount**
- **Emic/Etic Understanding of the Tableland Environment**