

# Adaptive Management and Planning Models for Cultural Resources in Oil and Gas Fields

Department of Energy Cooperative Agreement  
DE-FC26-02NT15445

## **PROJECT OVERVIEW**

**update to 2004 BLM National Fluid Minerals Conference**

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*prepared by*

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*with project partners*

**Wyoming State Historic Preservation Office**

**New Mexico State Historic Preservation Office**

**SRI Foundation (Rio Ranch, New Mexico)**

**Western GeoArch Services (Salt Lake City)**

**Red Rock Geological Consulting (Santa Fe)**

**BLM New Mexico and Wyoming**

**Note: This overview is intended for use and release only by active project partner organizations. It is not a general public information release.**

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# The Questions

- **How do we “close the loop” between science and management? What should be different? What works?**
- **What have we learned about the cultural resources in each study area?**
- **Could we have gained the same knowledge faster, better, cheaper? Could we have fed that information into management at more appropriate moments?**

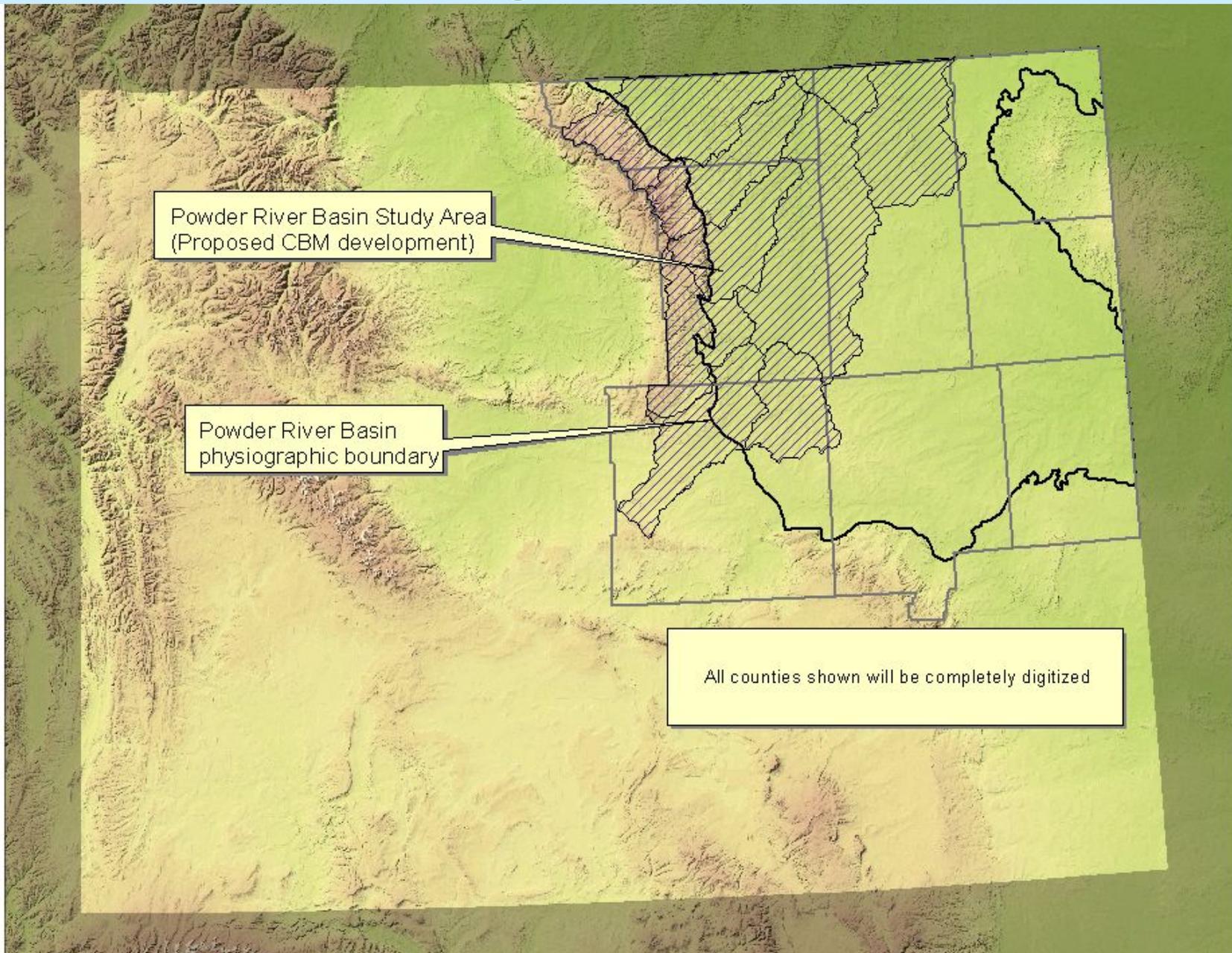
# Project Tasks – New Mexico and Wyoming

- **Data Development for GIS approach**
- **Geomorphology and site visibility**
- **Predictive Modeling of site density**
- **Inventory Simulations (how could we have done it better?)**
- **Management Recommendations (how SHOULD do we do it in the future?)**

# Project Activities – New Mexico and Wyoming

- **Create comprehensive digital data of existing cultural resource inventories and known sites**
- **Create landscape models to evaluate whether attributes and distribution of sites are predictable**
- **Evaluate if we could have gained knowledge more rapidly**
- **Examine how investigation and evaluation – in the context of management – can be better staged or timed more appropriately.**

# Wyoming Study Area





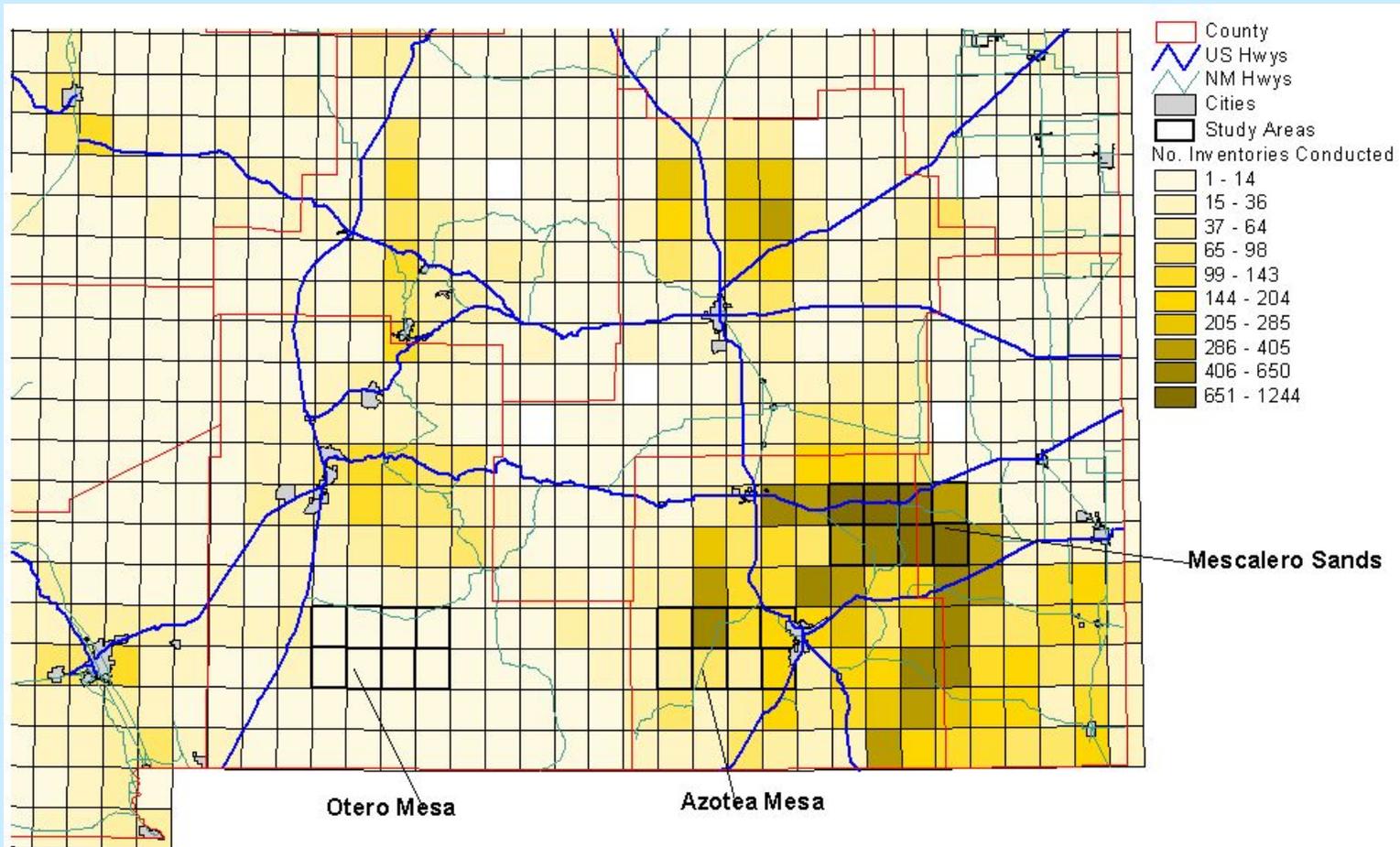
There is something wonderful about science. One gets such a wholesale return of speculation for such a trifling investment of fact.

-- Mark Twain *Life on the Mississippi*

# Measuring “Knowledge”

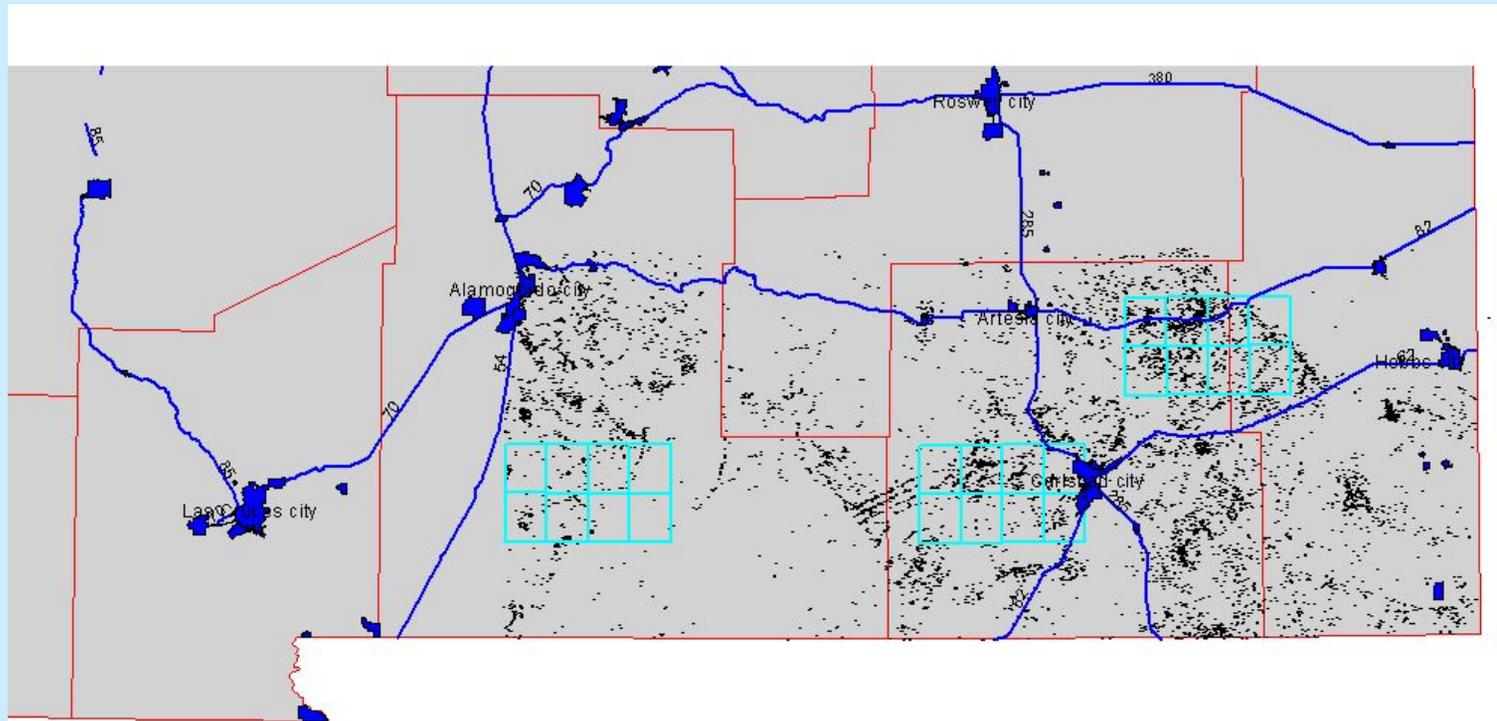
- Scientific interests vary by region  
Project team assessed what is considered “important” by professionals
- Using digitized data (much of which had to be digitized first!), we assessed when “knowledge” stopped accumulating from investigations.

# Watching the Needle (1)



**DOE PUMP III Study Areas  
Density of Previous Archeological Inventory**

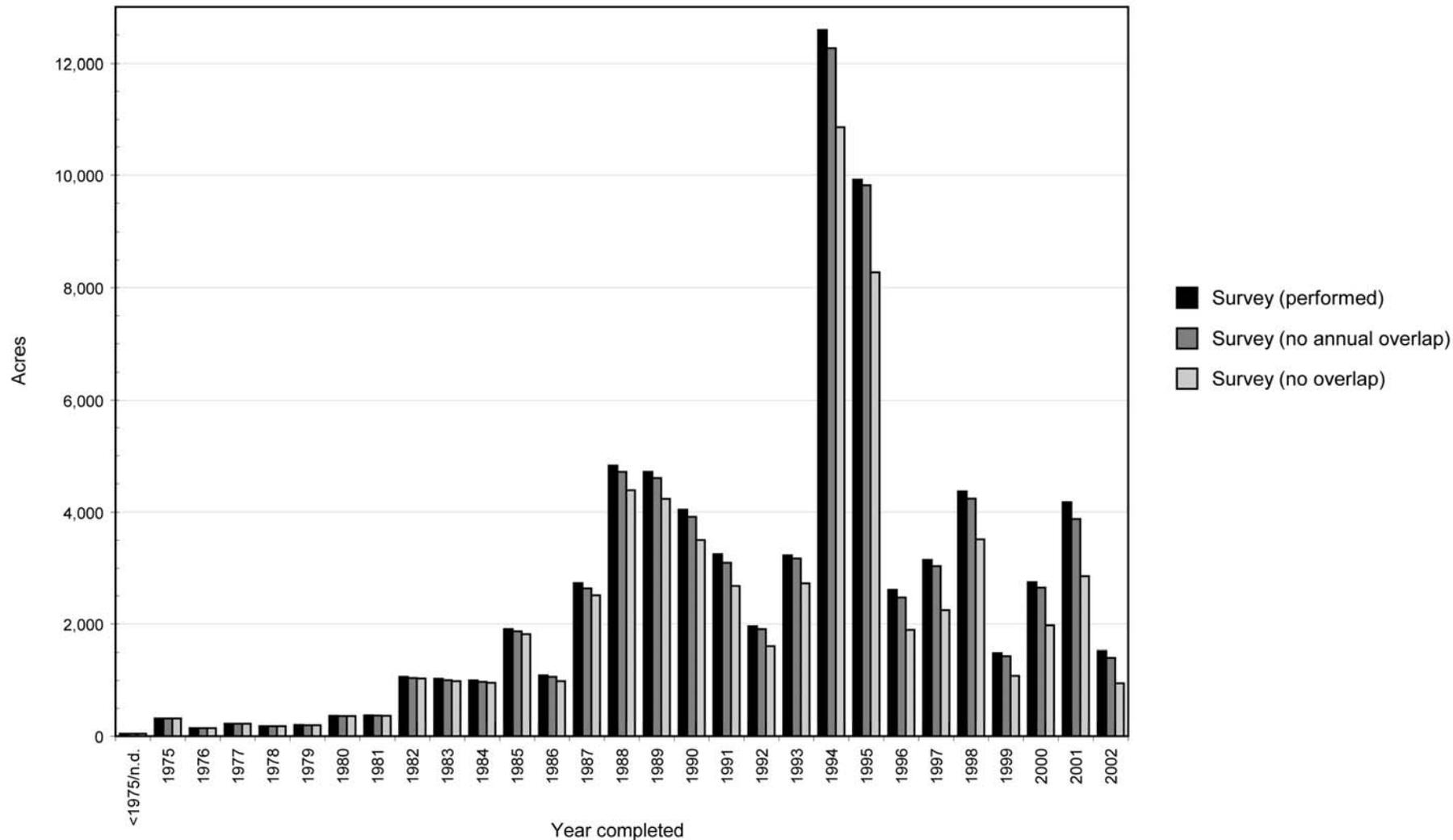
# Watching the Needle (2)



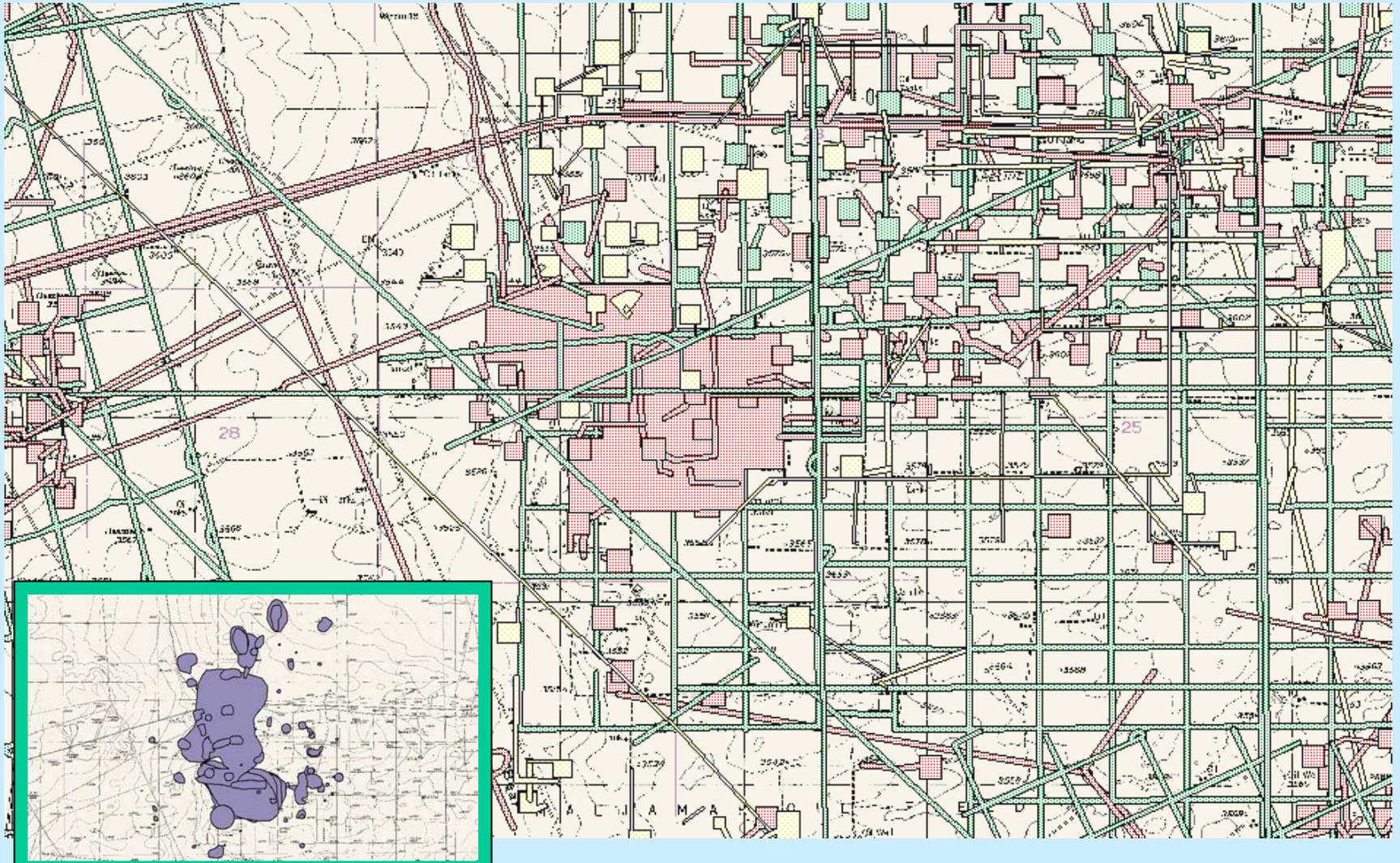
**DOE PUMP III Study Areas  
Archaeological Site Density**

- Cities
- ▲ US Hwys
- Study Areas
- Arch Sites
- County

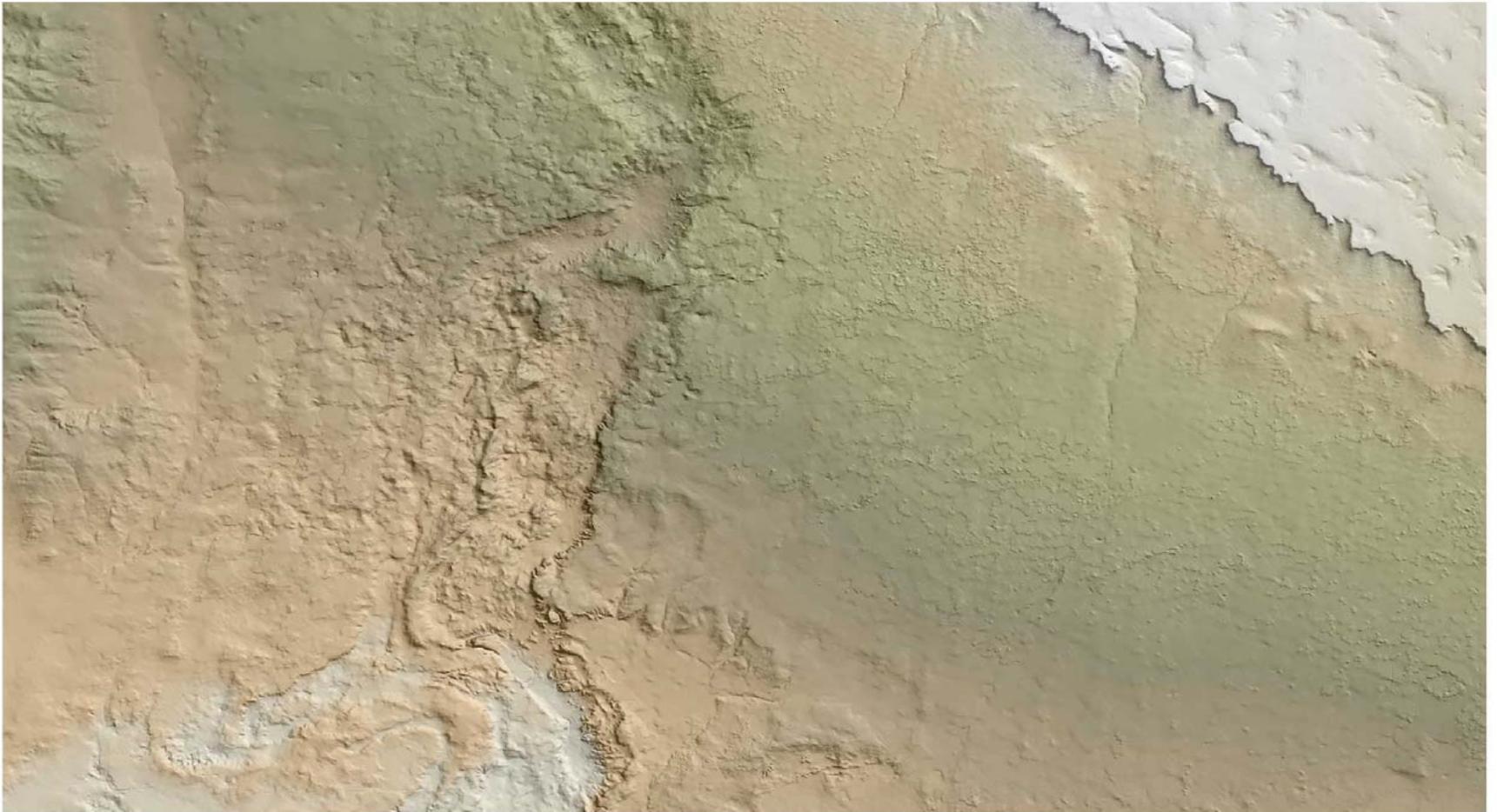
# Annual Survey Acreages – Loco Hills Study Area, New Mexico



# Inventory



## Digital Elevation Model (DEM) Over Hillshade



## Loco Hills - Geomorphology



### Geomorphology

- Coppice dunes, thin sand sheet
- Eroded limestone surfaces with thin soils
- Exposed Pleistocene playa deposits
- Floodplains of large drainages, with extensive Holocene deposits
- Floodplains of small drainages
- Parabolic dunes, thick sand sheet
- Quarry, potential source of stone materials
- Sand sheet of undetermined age
- Thick, uneroded Holocene playa deposits

**Weighting of variable classes for weighted sensitivity model.**

<b>Class</b>	<b>Description</b>	<b>Expected % of all cells with sites that would be found in this class</b>	<b>Observed % of cells with sites that actually fall in this class</b>	<b>Weight</b>
1	Coppice dunes, thin sand sheet	31.0	54.0	3
2	Eroded Limestone surf, thin soils	13.4	1.2	-3
3	Exposed Pleistocene playa deposits	0.05	0	0
4	Floodplains of large drainages, Holocene deposits	0.26	0	-1
5	Floodplains of small drainages	0.47	0.21	-1
6	Parabolic Dunes, thick sand sheet	54.67	44.31	-2
7	Quarry, potential source of stone materials	0.00003	0	0
8	Sand sheet of undetermined age	0.1	0.08	0
9	Thick, uneroded Holocene playa deposits	0.27	0.15	-1

Figure 12 Weighted sensitivity model with 3 classes (0–3). Class 4 is outside the boundaries of the project area.

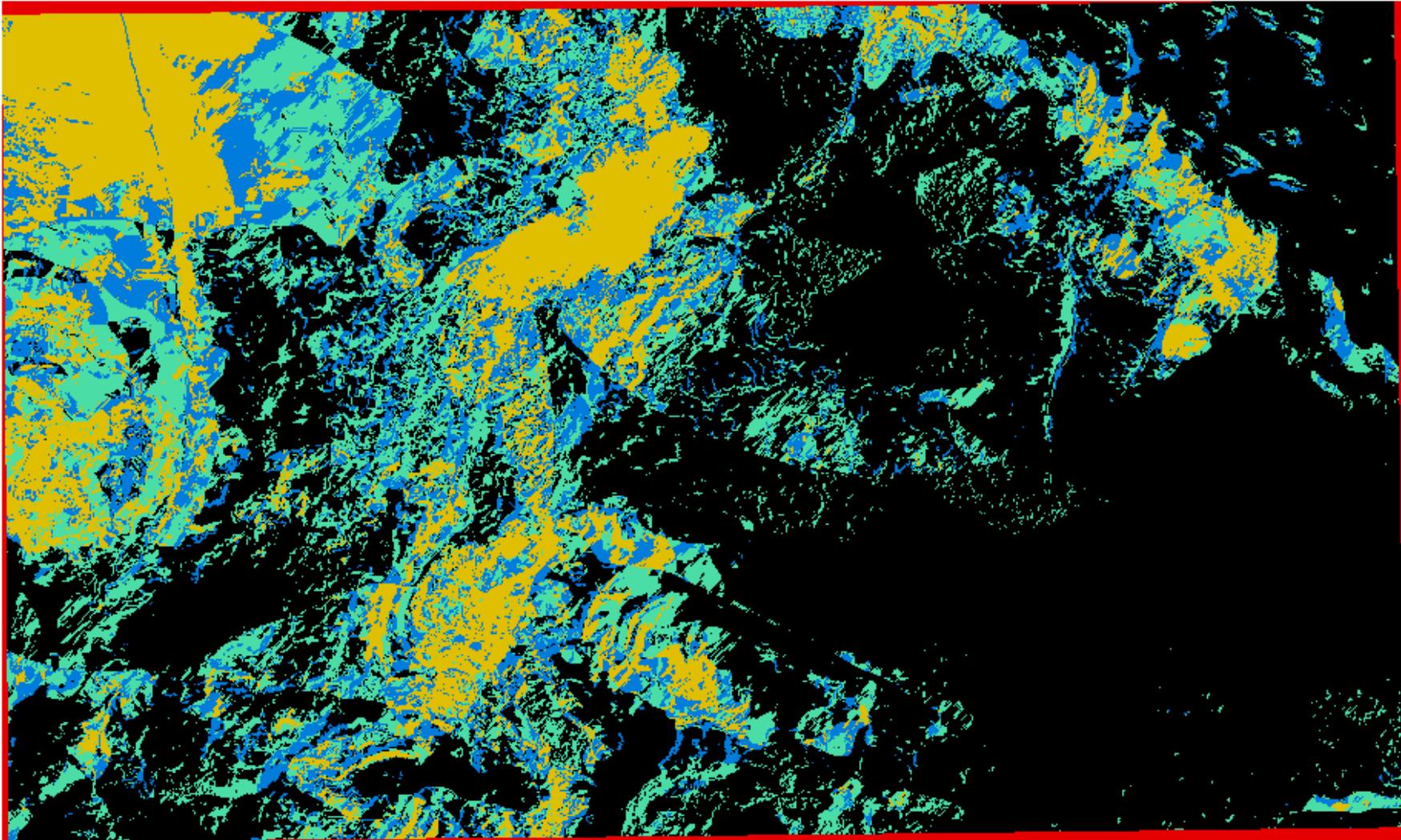
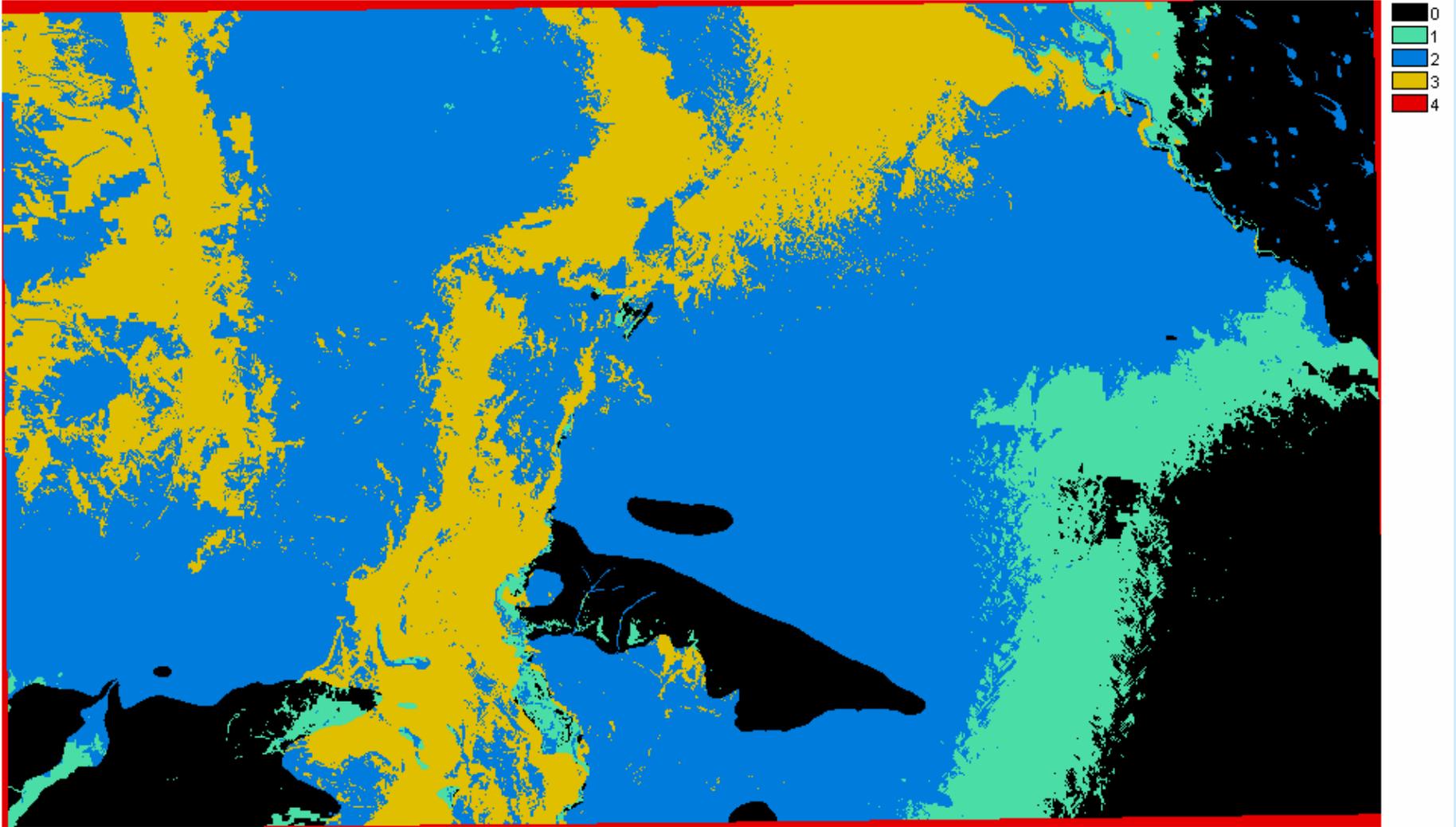
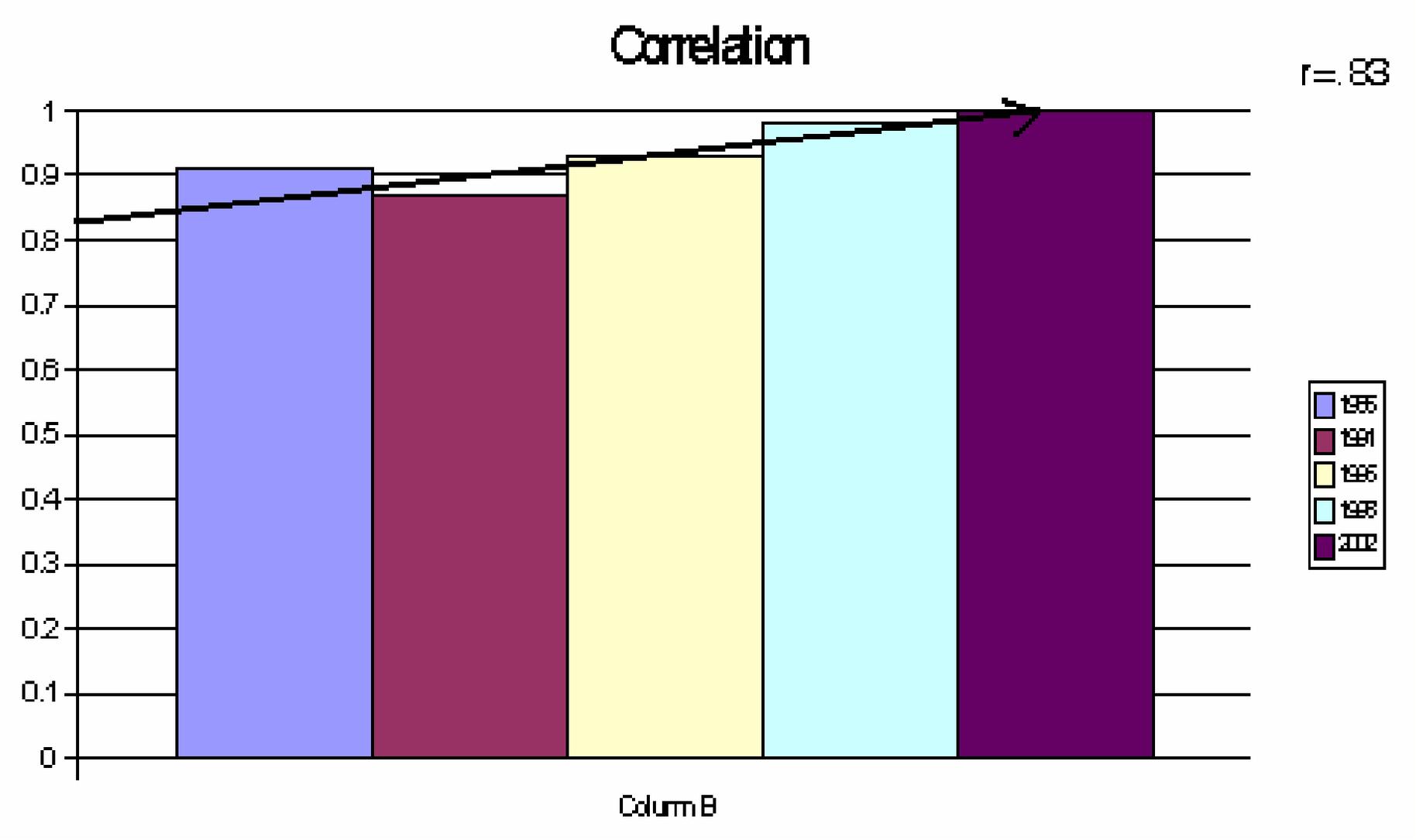


Figure 13 Logistic regression model with 3 classes (0–3). Class 4 is outside the boundaries of the study area



# Correlation logistic models by year to 2002 density



# Summary – Watching the Needle Example

- Site *density* revealed by inventory has not changed since mid-1980's.
  - Inventory could have focused on something else since then
- Predictive models would have worked as well in 1990 as they do now.
  - Again, information collection could have focused on something different

# Loco Hills Knowledge

- Focus on site density as a proxy for settlement
- Survey data insufficient for analysis of temporal or functional variability in Loco Hills
- Sensitivity maps closely track geomorphological units (coppice dunes high and parabolic dunes low)
  - Adaptation preferences or archeological visibility?
  - Further survey will probably not help to answer this.

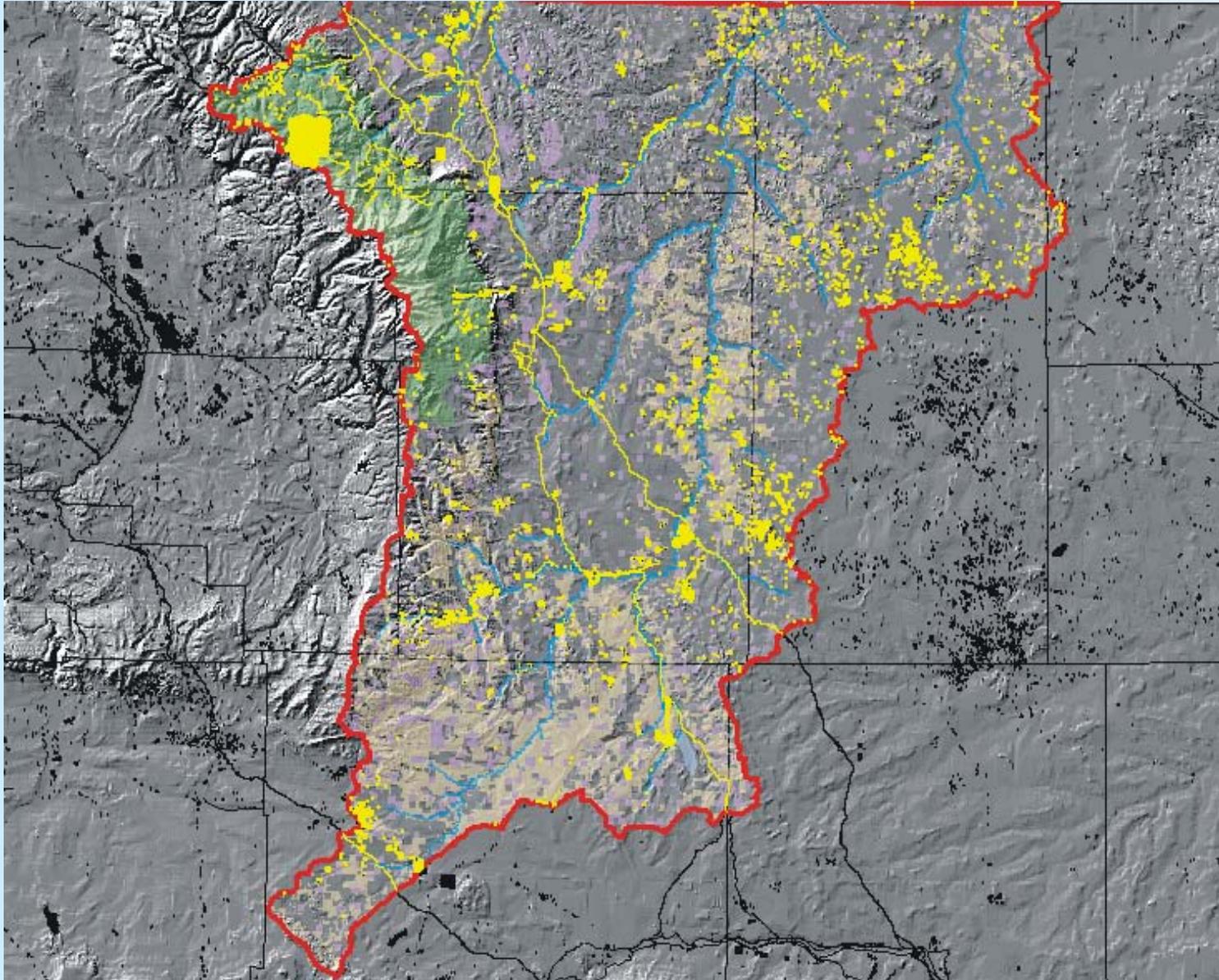
# Adapting Management in Loco Hills

- **APE- Based inventory is no longer adding any meaningful knowledge in Loco Hills. Time to pool data recovery?**
- **Early large-area inventory might have revealed much the same knowledge in hand now at a far lower cost**
- **The mandate to protect the information value of cultural resources (Criterion D of the National Register) might better be achieved through shifting to data recovery sooner**
- **Effective GIS data systems can reduce siting, review, and inventory costs**

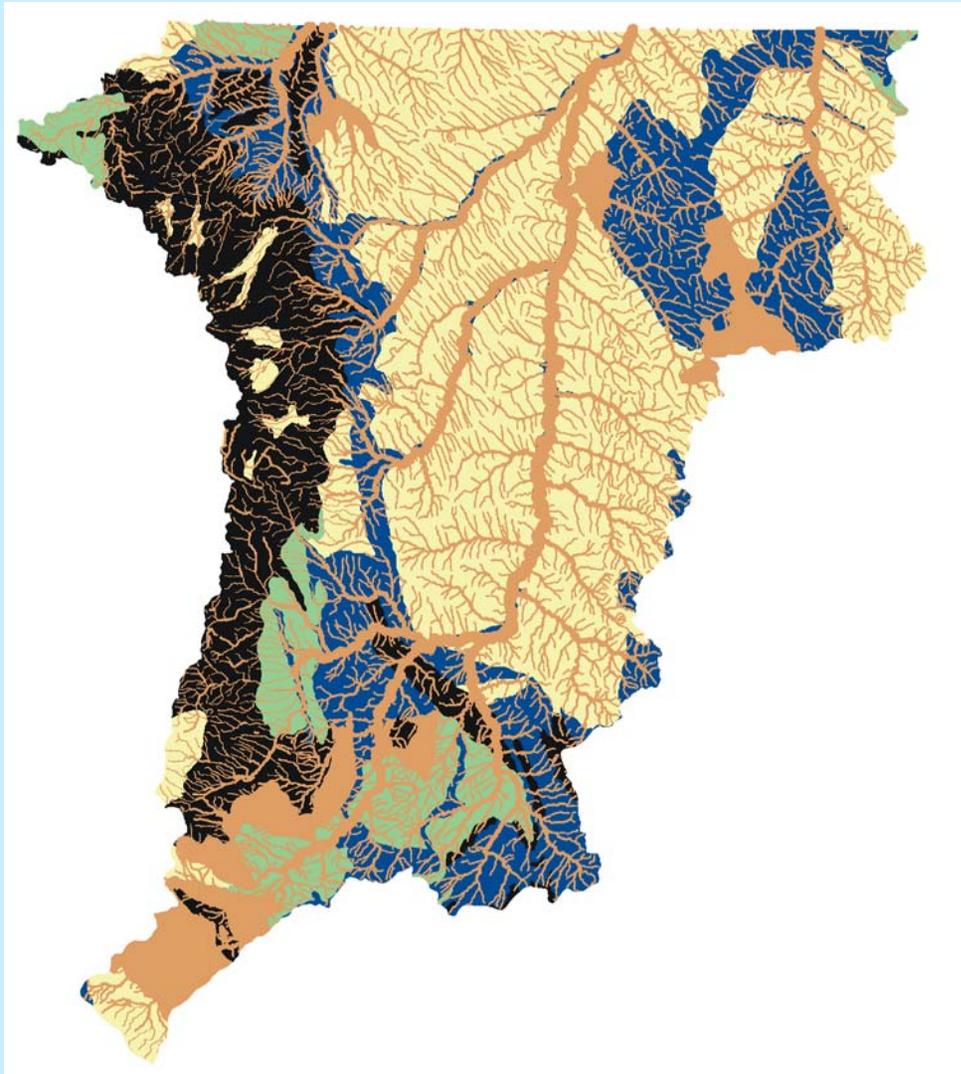
# Wyoming Accomplishments

- **Digitization of northeastern Wyoming completed**
- **Geomorphic (buried site) models in second, final) cycle of iterative testing**
- **CRMTracker (web-based collaborative project tracking) in place in Wyoming with BLM FOs, consultants, and SHPO**
- **“Red flag” summaries for planning in-place and available to industry upon request**

# Site Distribution



# Burial Models



*Weighted sensitivity model for Wyoming study area*

- 0 - very poor chance of containing a site
- 1 - poor chance of containing a site
- 2 - good chance of containing a site
- 3 - very good chance of containing a site
- 4 - excellent chance of containing a site

# Desired Outcomes

- Full GIS and data systems (useful in themselves and a necessity for analysis)
- Figure out how to implement “learn more” strategies
- May involve trade-offs in investigation strategies and staging -- a BLM and SHPO discussion
- Develop field tools -- manuals and etc., to implement revised strategies.
- Utilize, where possible and feasible, the geomorphology buried site models, erosion field indicators, and field assessment tools developed by the geomorphology and geoarchaeology team
- Involve appropriate parties *in the whole process*.
- Focus on knowledge, not just information

# Project Timeline

- 1/2003 Project start
- 6/2003 Initial data population for SE NM
- 9/2003 Analysis measures for NM fields drafted
- 12/2003 Measures, prelim info reviewed
- 12/2003 NM Geomorphology draft complete
- 1/2004 Initial data population for Wyoming
- 2/2004 WY Geomorphology draft complete
- 4/2004 WY inventory adequacy screening done
- 5/2004 Draft NM report done
- 9/2004 Draft WY management tools done
- 12/2004 Project complete

# Further information

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