

Field Applications of Large-Area Cultural Resource Datasets

Eric Ingbar (Gnomon, Inc.)

Kirk Halford (BLM Bishop FO)

Environmental Systems Research Institute

User Conference

San Diego, California, August 6, 2008

The Message You Are About To Hear

- Large area datasets are becoming ever more available
- Large area datasets have great utility in management, analytical and field applications
- “With great power comes great responsibility” – there are limits and cautions on using large area datasets
- Focus in this talk is on model-formation uses of large area data and applications of models

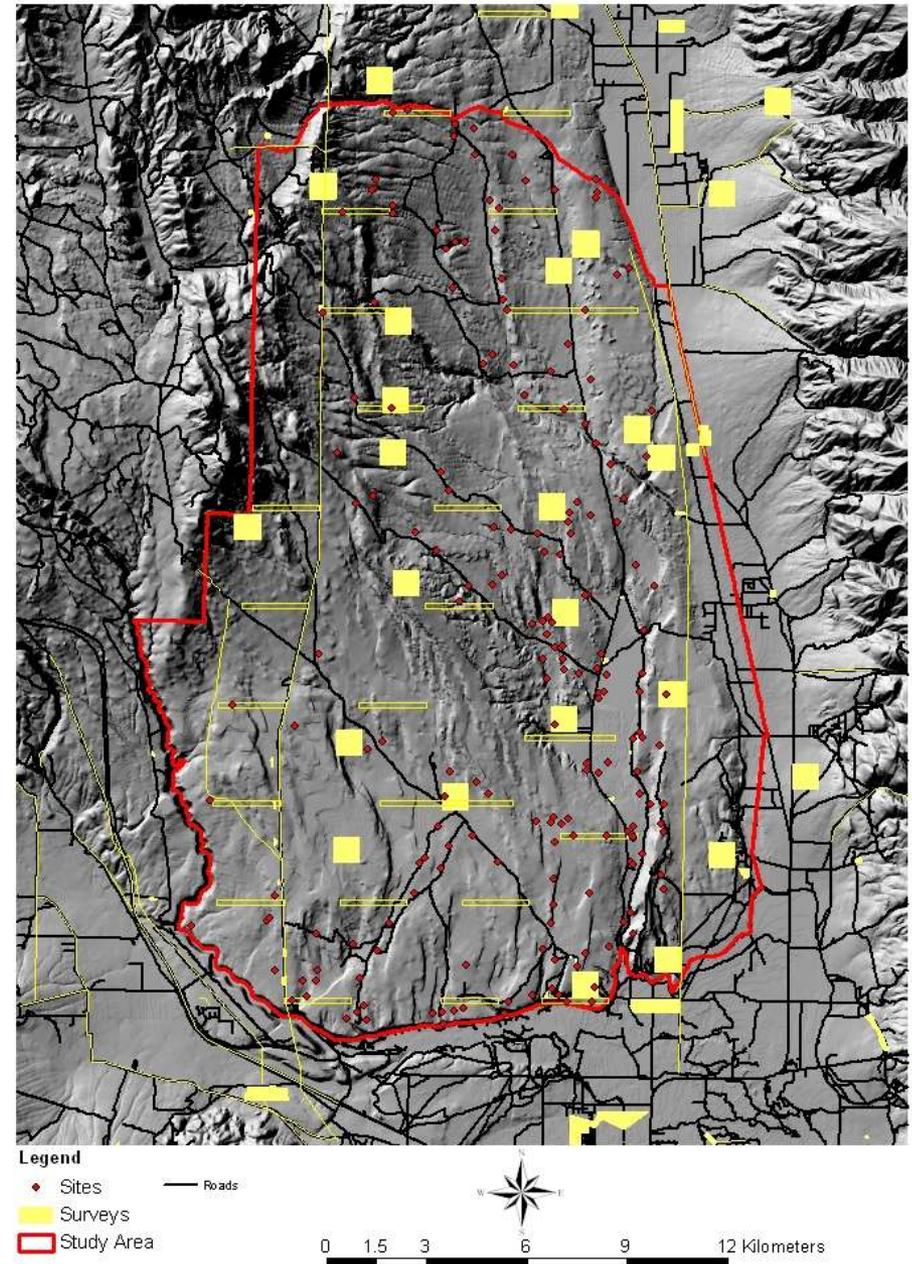
Large Area Datasets

- Definition: datasets of site and systematic inventory covering more than 100 square kilometers (often far larger)
 - Not necessarily inventoried completely.
- Mostly a “western thing”
 - But, several eastern states have statewide archaeological datasets / GIS

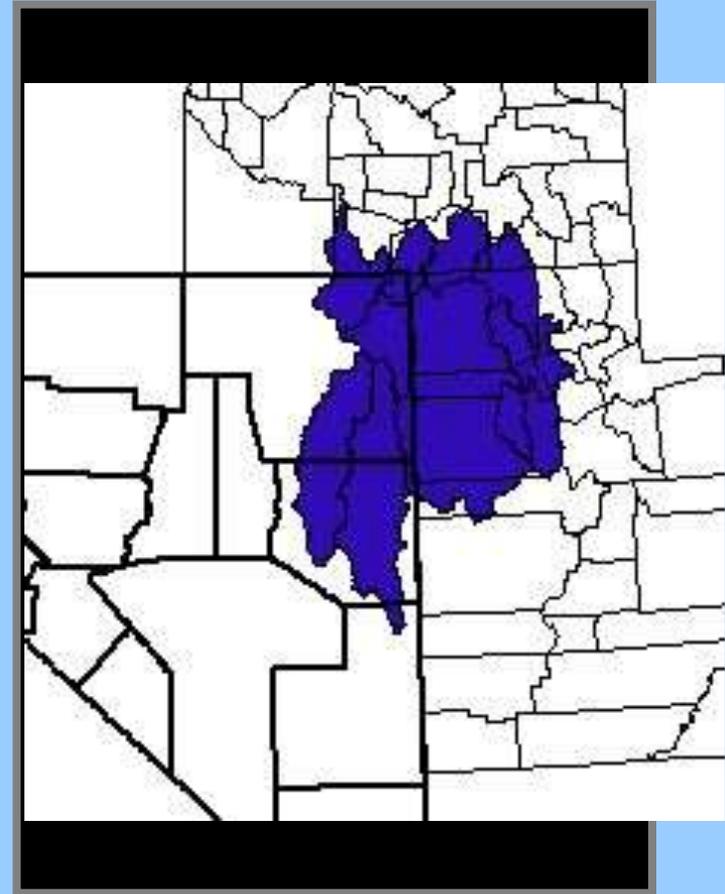
Analytical Areas may range from “small”

Bishop Field Office
Volcanic Tablelands Study

Approximately 100,000 acres



... to huge areas



DOE Pump III Study Area (Wyoming and New Mexico). GBRI Study area (Nevada, Utah, Idaho)

Reliance On Base Cultural Resource Data

- BLM, SHPOs, USFS have made major efforts to create large seamless datasets of:
 - Resources (esp. arch. Sites)
 - Inventories

But here is the question: what can we with these datasets beyond map checks?

Uses

- Administrative planning
 - Forest Plan, RMP, etc.
- Models / forecasts
 - Forecast
- Public applications
 - Making forecasts and summaries available to appropriate planners, proponents, etc.

Some Approaches to Models

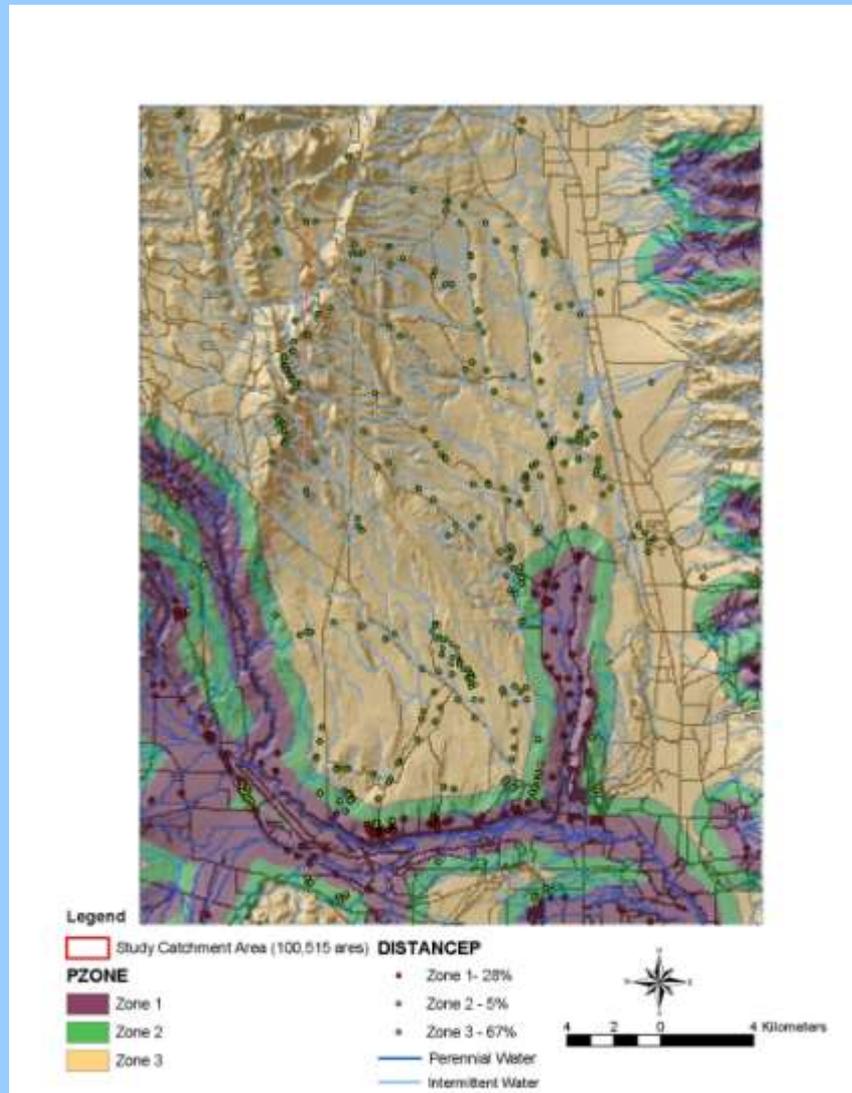
- Causation: Understanding why humans used particular places in particular ways
- Correlation: Observing associations between archaeology and other observable landscape attributes
- Preservation models: Archaeology is only where it is preserved

Focus on Two Projects

- BLM Bishop FO Volcanic Tablelands
 - “First principles” about hunter-gatherer settlement
 - Tested validity of first principles by then building a model
- GBRI Management Study
 - Correlation between known sites/site density and environmental factors
 - Different forecast factors in different watersheds
- From each
 - What did we learn (not just how)?
 - How do we use the knowledge?

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)



Cultural Sensitivity Zones

- **Probability of Significant Site Occurrence**

- **Zone 1 – High Probability**

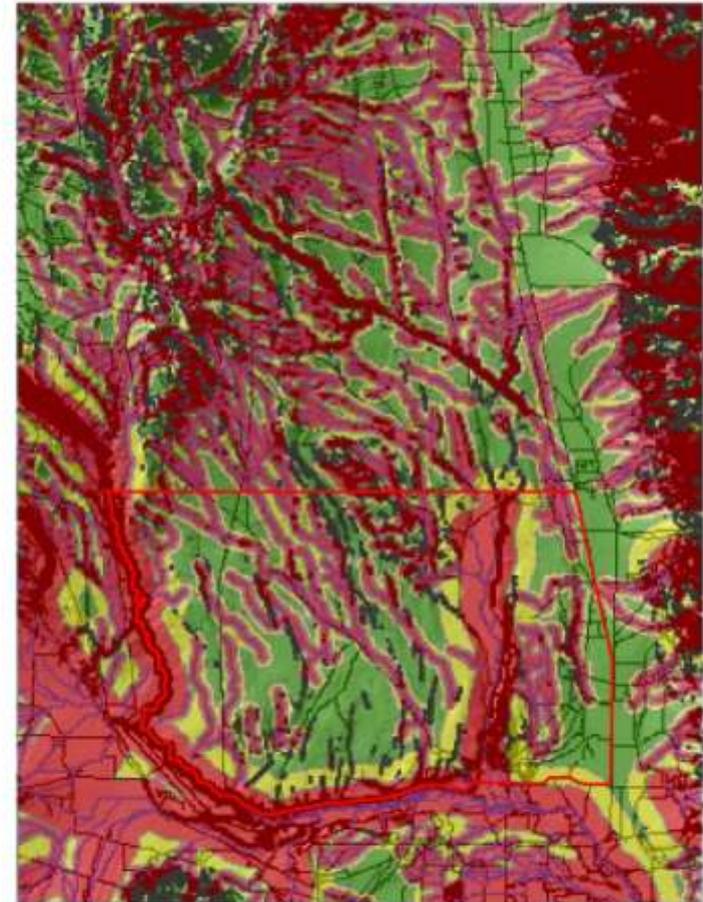
- On Fault
- Within ½ Mile of P Water
- Within 1/8 Mile of I Water

- **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

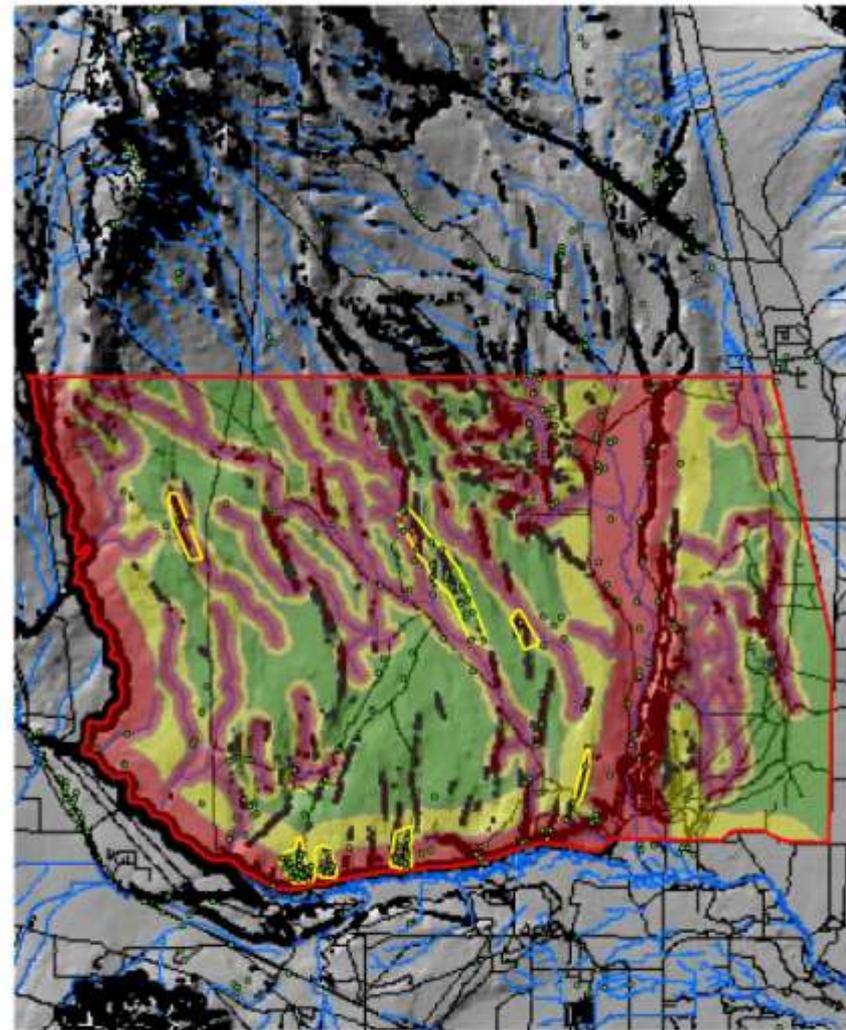


Results Within The Study Area

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 (1,003 Acres)
- Intermittent Water
- Perennial Water

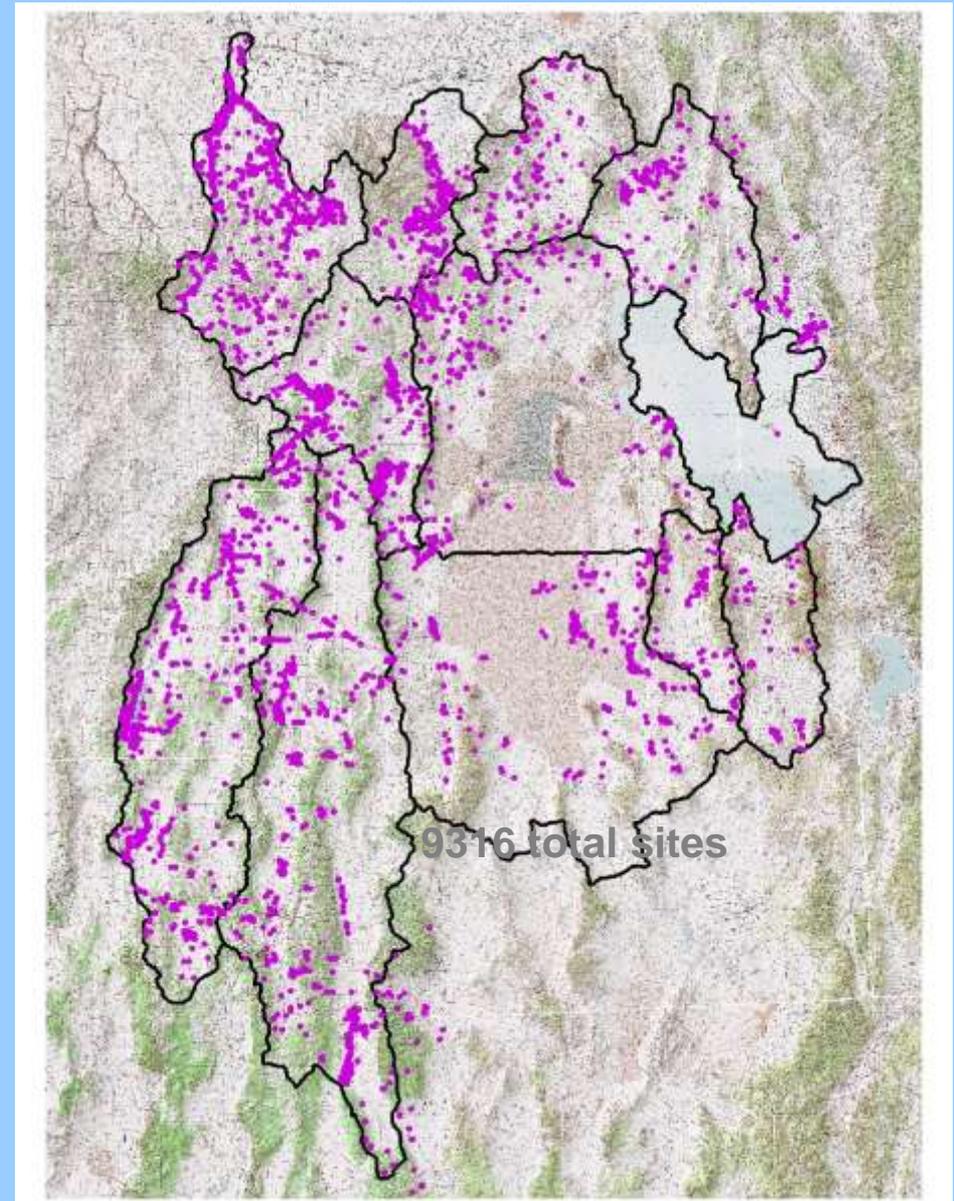


Gains

- What did we learn?
 - The hypotheses about hunter-gatherer settlement behavior in the Tablelands were not disproven
- How do we use it?
 - Protect the resource
 - Save people from themselves (bouldering)
 - Extend the hypothesis to forecast other areas and other use situations

GBRI – Site Data

- Source
 - NVCRIS
 - UTAH SHPO GIS
 - IDAHO SHPO spatial data from CR database
- Site points, polygons
 - Convert to site centerpoint for all data
- Inventory polygons where available



Cultural Resources – Assemblage

Data

- **Source**
 - **SHPO databases**
- **Convert to presence/absence in IMACS encoding format**
- **Link to SHPO databases**
- **Link to GIS spatial data**

Model Formulation

- “Independent” environmental datasets (slope, water, vegetation, landform)
 - Many partial correlations
- Sought association between independent attributes and presence of archaeology
 - Weights of evidence analysis
 - Confirmation by logistical testing

GBRI Outcome (1)

- Different associative values for different major study areas!
 - Did hunter-gatherer “act different” in different places?
 - Or is it just that archaeology is preserved/visible differently in different settings?

- **PILOT-THOUSAND SPRINGS**

- Area within 900 meters of water is strongly predictive for sites
- Barren areas and steep slopes are strongly predictive for *no* sites
- *Cautions: Very few sites within 0-500 meters of streams. Sites are clustered in 500 to 900 meters of streams.*

- **STEPTOE VALLEY**

- Sagebrush zone and flats are strongly predictive for sites
- Upper slopes, side slopes, upper slopes, desert shrub and barren vegetation zones are strongly predictive for *no* sites
- Proximity to water is not a strong association

Using Model Results

- GIS data at several levels of specificity for cultural resource specialists
- “Likelihood” forecasts for planning and response
- Can we identify problem areas? Areas of highest potential conflict?

The “ologist” data

- Sites and inventories
 - (as part of – statewide systems created by multiple agencies, especially SHPOs)
 - confidentiality
- Where has inventory occurred?
 - Not necessarily limited to “ologist”
- What, in general, is known?
 - Not necessarily limited to “ologist”
 - Summary by inventory area
 - Summary by section (sq. mile)

Likelihood forecasts

- *Models are never done! But...*
- Can share likelihood forecasts as GIS data
- Need to educate on LIMITATIONS of model-building and utility
 - Ex: parts of model process use very large, coarse vegetation data
- Models are NOT compliance actions

How do we use it?

- Make info available to managers/planners with sufficient background – GIS web
 - Cultural resource specialists in each office create “curriculum” for web-users (authorization process)
 - Authorized users can view summary cultural mapping, relevant fire-mapping, etc.
 - Can pull down data, e.g., resource specialist heading to a fire IC

With Great Power...

- How secure is our knowledge?
 - What if we had better data on something like water distribution 1000 years ago?
- Models and large area data are NOT consultation and compliance
- What does “distribution of sites” mean over large areas?
 - We only looked in certain places?
 - Could we ever get enough support to field test a model over multiple states?
 - How good is all that cultural data anyway?
- User education is critical