

GIS AS A PRIORITIZATION AND PLANNING TOOL IN ABANDONED MINE RECLAMATION

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Abandoned Mine Reclamation Program

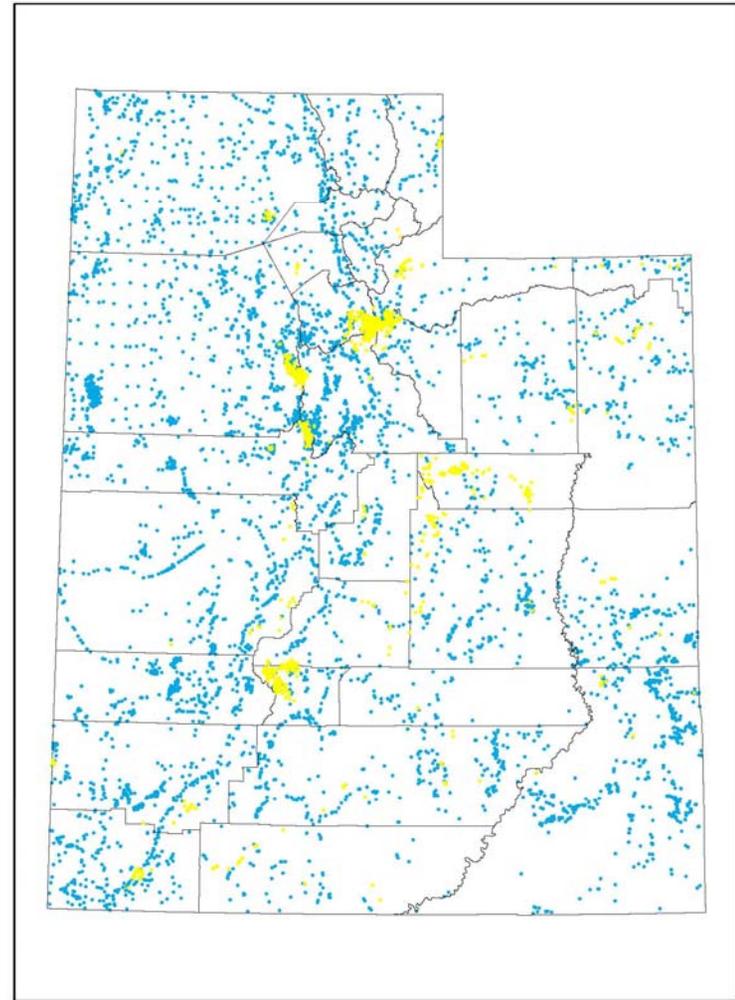


Utah Abandoned Mine Reclamation Program

- Program started in 1982
- Approximately 5000 abandoned mines of the states estimated 22,000 abandoned mines have been closed

Almost all abandoned
Coal mines have been
Closed.

For the UAMRP to
Achieve primacy under
SMCRA a plan was
needed



Model Creation

- How to address abandoned mines
- How abandoned mines are scored
- More automated system to analyze data
- In the 1990's most coal work complete and more non-coal site are being addressed
- By the 1990's selection process needed refinement
- Advancements in GIS

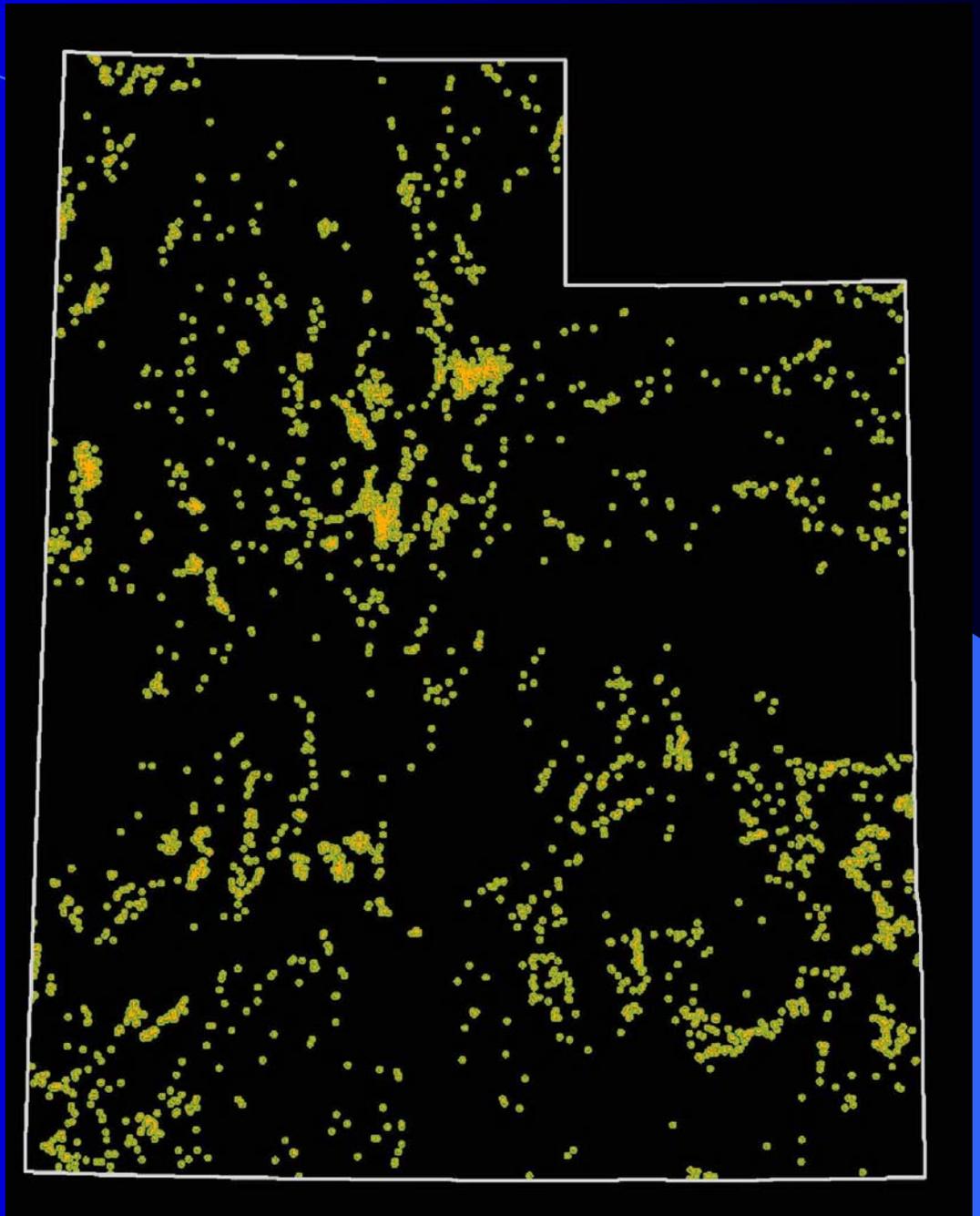
Conceptual Formulation of the GIS Model

- How the model developed?
- What was thought to be in the model?
 - CRIB/UMOS
 - Mining claim locations
 - USGS mine adit and shaft symbols
 - Geologic maps
- What was ended up with in terms of available data?
 - Accessibility
 - Proximity to population
 - Proximity to reclamation
 - Use by OHV

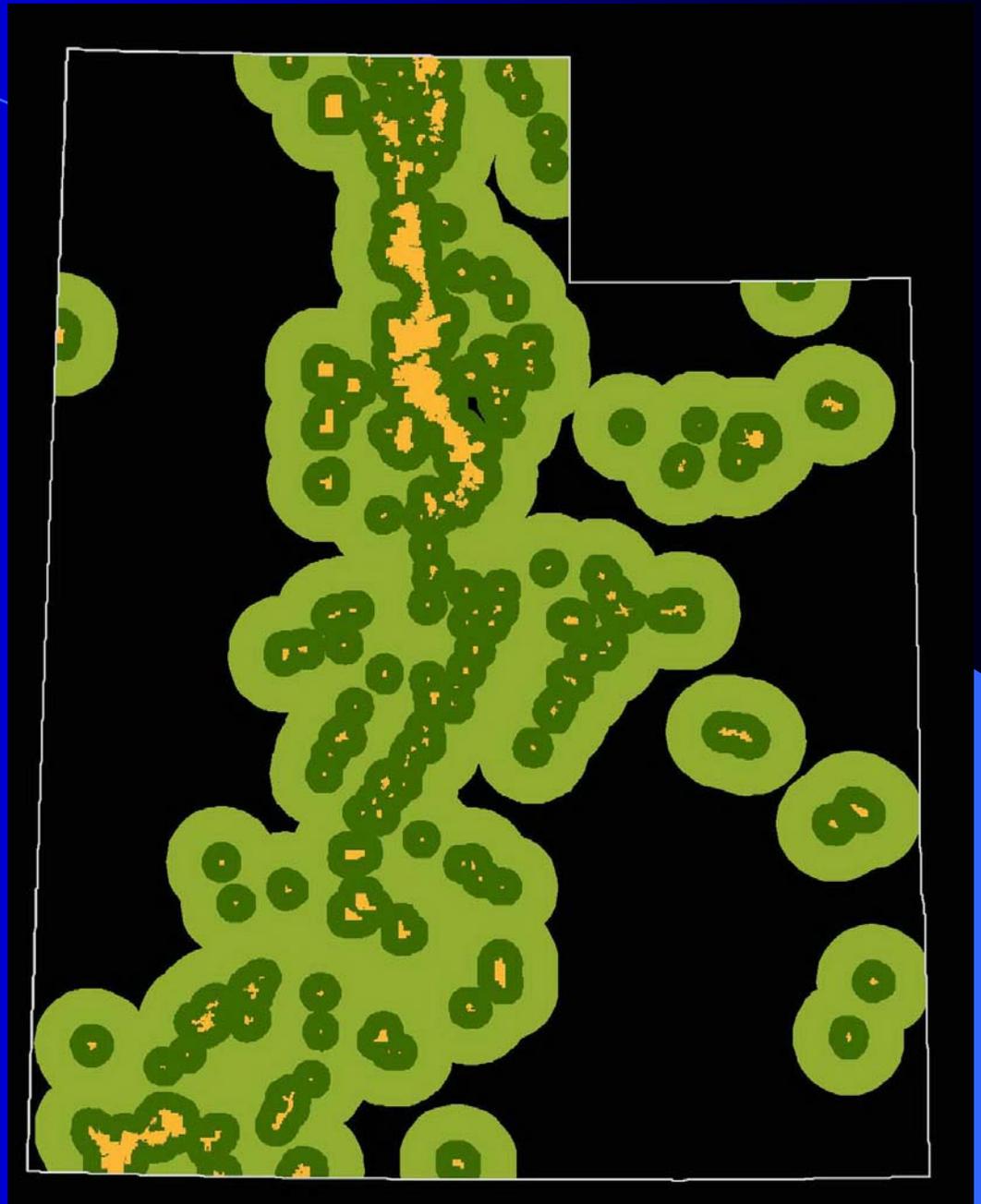
Conceptual Model

- Three main factors
 1. Known mining activity or mineral resource occurrences
 2. Population density
 3. Proximity of access to mining area

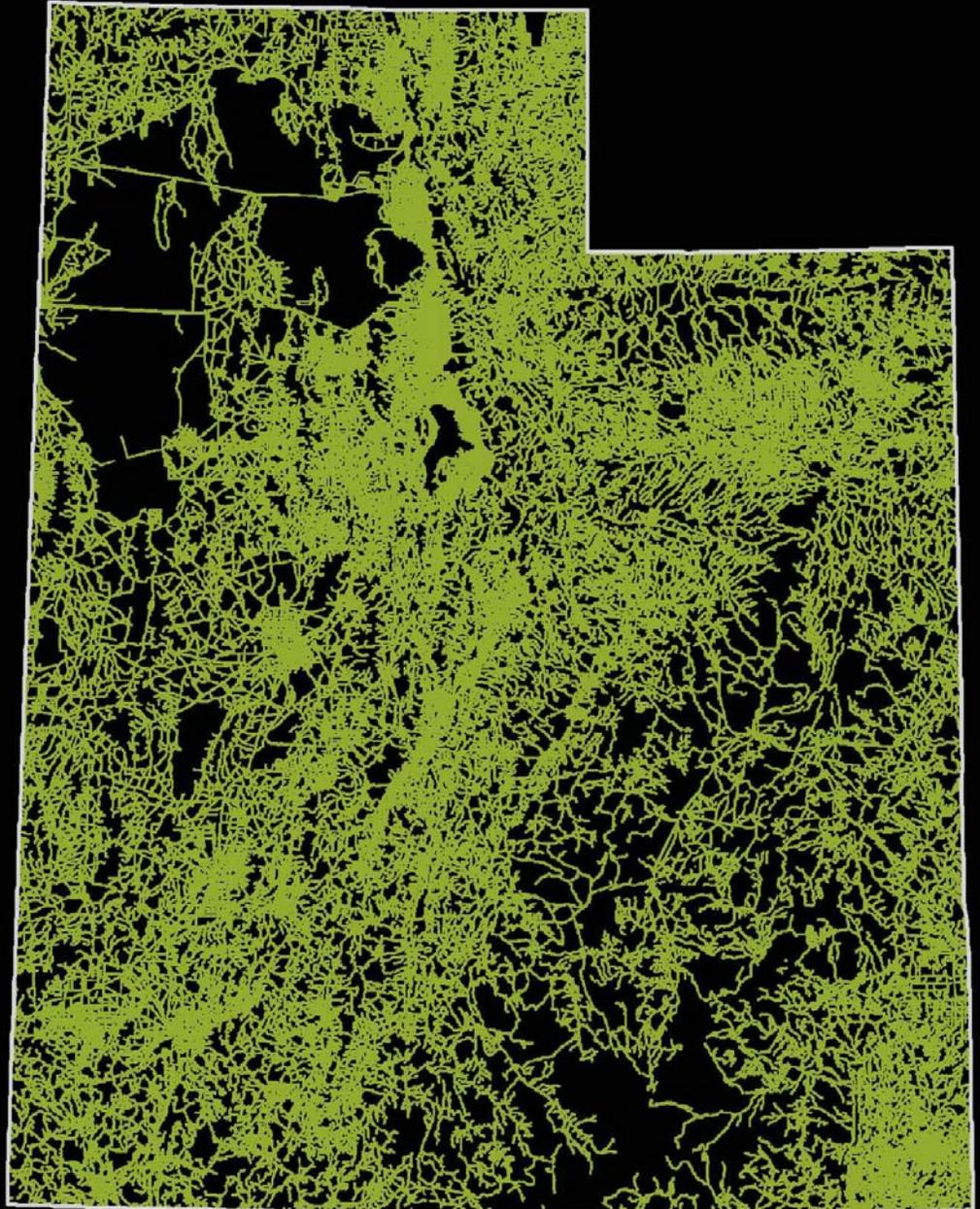
Computerized
Resource inventory
base data (CRIB)



Mines proximity to population centers



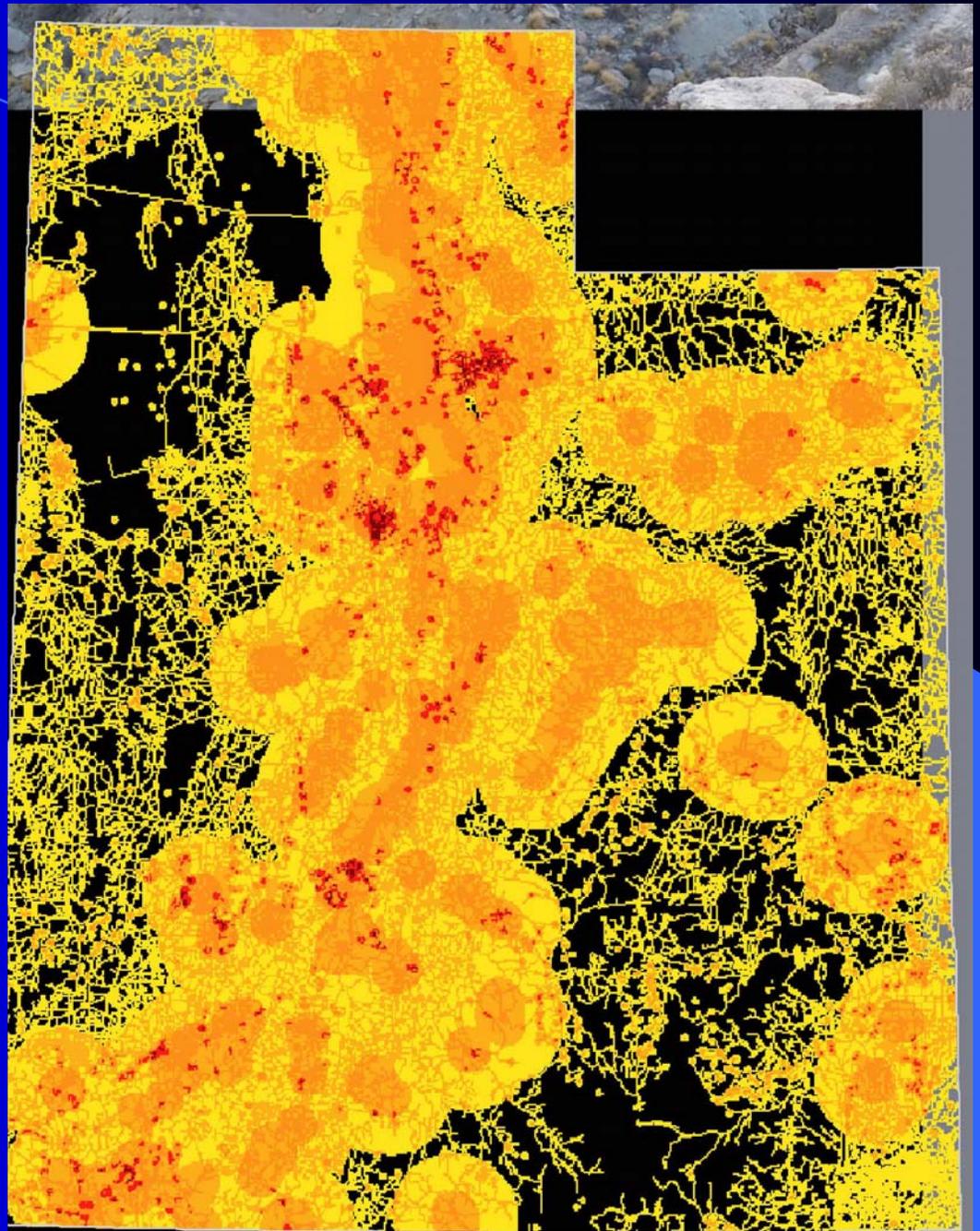
Accessibility to mines



Technical Implementation of the GIS Model

- (ESRI) arc/info software
- ESRI's Arc macro language (AML)
- Data sets used for in the model
- Access (road coverage's)
- People (2000 census data)
- Mining and mineral datasets

The GIS Model



Adaptability of the GIS Ranking Process

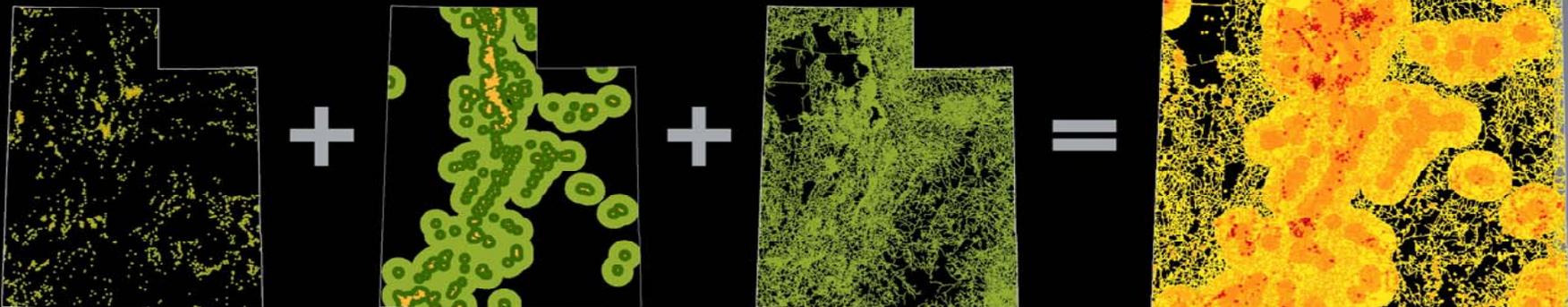
- Concentrate our resources where they are most needed
- Indicates portion of the state that need additional work to refine datasets
- GIS is helping us prioritize and plan for the future

GIS as a Prioritization and Planning Tool in Abandoned Mine Reclamation



State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
September 8, 2009

OVERVIEW The goal of the Utah Abandoned Mine Reclamation Program is to "mitigate adverse effects of past mining practices by identifying and prioritizing abandoned mine sites, securing funding for and clearing, and monitoring reclamation projects." (AMRP Mission Statement) In recent years we have been using GIS at varying levels to assist with these goals. This year, we are developing a system to rank and prioritize abandoned mine site areas for reclamation. In this simplified example we have used three different data layers in conjunction with each other to assign a hazard rating to all areas in the state. We are excited to realize how fast this process is with a GIS system, when compared with processing the same information from paper records.



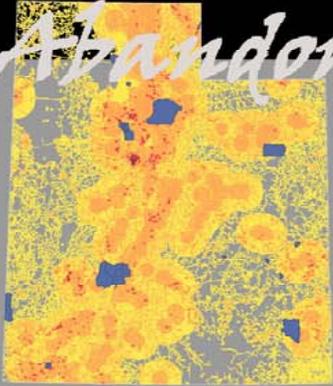
Where are the mines? CRIB Data
The first step in ranking mines for reclamation is knowing where they are. Computerized Resource Inventory Base (CRIB) data is provided jointly by the Utah Geological Survey, Bureau of Land Management, and U.S. Geological Survey. It is currently maintained for Utah by the Utah Geological Survey on 7.5 minute quadrangles and in a tabular database. This version is a point coverage providing information about the locations of mines and mineral occurrences in Utah (excluding sand, gravel and coal).
CRIB data helps us narrow down the locations of mineral mining activity. To make a coverage that could be overlain and analyzed, we started with the CRIB point coverage. The original points were buffered with radii of 0.25 miles and 1 mile. The resulting coverage was converted to a GRID with 0.5 mile grid cell size. Cell values in the quarter mile buffer were coded with a value of two. Cell values in the one mile buffer were coded with a value of one.

What is near the mines? Municipalities
One of the ranking criteria we use to prioritize abandoned mine closures is the mine's proximity to population centers. This gives us an idea of the level of visitation the mine receives. We want to seal the most hazardous mines first, and more visitation equals more hazard. To see the proximity of mines to population centers, we started with a polygon coverage of the municipal boundaries throughout the state, supplied through the Utah AGRC. The original municipality boundaries were BUFFERED with radii of 5 miles and 10 miles. The resulting coverage was converted to a GRID with 0.5 mile grid cell size. Cell values in the five mile buffer were coded with a value of two. Cell values in the ten mile buffer were coded with a value of one.

How do we get to the mines? Accessibility
We want to rank our mine closure priorities in a way that reflects how much exposure to the danger the public is getting. Again, high visitation is a concern that results from easy accessibility. The easier a mine is to get to, the more people visit it. To see the accessibility of mines from roads, we started with the coverage of the roads throughout the state, supplied through the Utah AGRC. The original roads were BUFFERED with radii of 0.25 miles. The resulting coverage was converted to a GRID with 0.5 mile grid cell size. Cell values in the quarter mile buffer were coded with a value of one.

Where is the greatest hazard? Illustrating Our GIS Model
Grid coverages of BUFFERED and coded CRIB data, municipalities, and roadways were overlain and mathematically summed in ARC/INFO GRID to produce this composite grid showing the combined hazard ratings. Each factor's code is summed with the overlying codes to increase the hazard rating at locations where mines, municipalities and roads overlap. The areas with the highest codes show as darkest red on this map. This combined hazard map illustrates the basic concept of how we can determine which abandoned mines pose the greatest risk to the public.

Abandoned Mine Reclamation



What have we done so far? Completed Reclamation Projects
GIS can also help us see how far we have come in the process of reclaiming Utah's estimated 20,000 abandoned mines. The GIS polygons were digitized from project records, indicating the boundaries of completed reclamation projects. These boundaries, by definition, mean that all the land within them has been inventoried and we have reclaimed abandoned mine openings on that land.
Where will we go next? Prioritizing Abandoned Mine Sites
This is where GIS really comes into play. By inputting all available mine site location and potential visitation data we can utilize our GIS model to assign hazard ratings and prioritize areas for future investigation. We can also eliminate from consideration those areas in which there is no potential abandoned mine related hazard. GIS is helping us to concentrate our efforts and resources in those areas where they can do the most good.



Reclamation Program



The Bottom Line
This pie chart shows (in percent area) how far we have come in our task of safeguarding the public from abandoned mine related hazards in Utah. The blue section represents the portion of the state in which abandoned mine reclamation has been completed, the gray section represents the portion of the state in which there is no potential abandoned mine related hazard, the remaining orange area indicates the portion of the state that we have left to investigate on the ground. GIS will help us maximize our limited funding by streamlining the process of prioritizing and planning our future work in these areas.