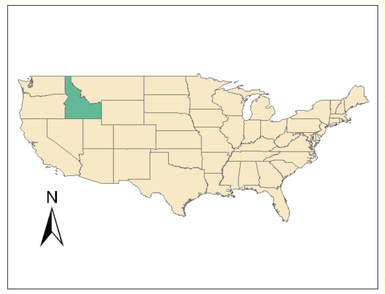
Geothermal Power Plant Site Selection in Idaho

Overview

In this study, GIS was used as a decision-making tool to target potential geothermal power plant sites in Idaho. The use of geothermal energy for electric power generation has become widespread because of several factors. There are environmental benefits, unit sizes are small, geothermal plants can be built much more rapidly than plants using fossil fuels, geothermal is a preferred resource because it cannot be transported for sale, and the use of geothermal energy enables fossil fuels to be used for better purposes.

Study Area

The original study area was the state of Idaho. According to U.S. Geological Survey estimates, Idaho ranks seventh among the 50 states in developable geothermal energy. These resources could provide up to 20% of Idaho's heat and power needs. The Department of the Interior plans to make available 190 million acres of federal land in a dozen Western states, Idaho being one of them, for development of geothermal energy projects - a move that could produce enough electricity for 5 million homes.



Methodology

After comprehensive search for available data in the area, the layers we organized into two categories; technical dataset (hot springs and wells) and socio-economic dataset (access to population centers), GIS was used to carry out a suitability analysis and site selection process because it can handle a large amount of geo-referenced data and information. Data was collected in vector format, converted to raster data, reclassified according to suitability, and then re-converted to vector form to utilize various vector analysis tools.

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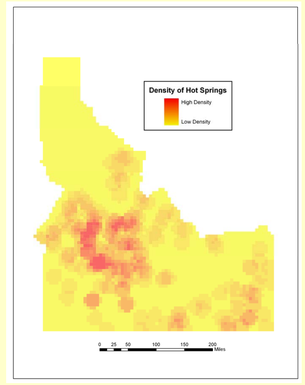
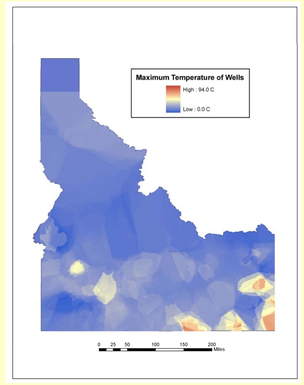
Dept. of Geology, Spring 2009

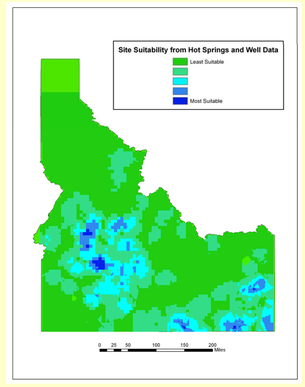
Evidence Layers

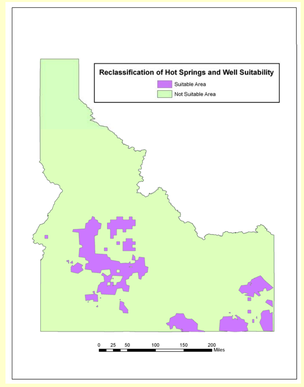
Hot springs throughout Idaho were plotted and then converted to a raster image to show high density areas meaning increased fluid flow near the earth's surface. Previously drilled wells were also plotted, and a raster image was created showing the range of temperatures. High temperature wells and presence of hot springs are both critical for access to geothermal power.





These maps were added using the raster calculator to produce a suitability map for geothermal development. This map was then reclassified to show suitable areas vs. non-suitable areas.

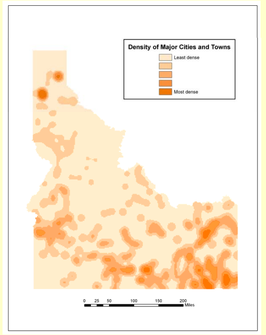


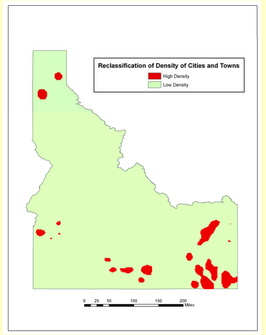


Sources

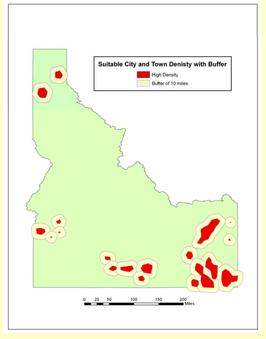
Great Basin Center for Geothermal Energy
http://www.unr.edu/Geothermal/datalist.html
National Geophysical Data Center Listings: Idaho
http://www.hotspringsenthusiast.com/Idaho.asp
SMU Geothermal Lab: Geothermal Data Files
http://smu.edu/geothermal/georesou/usa.htm
National Atlas Map Maker: Census and City Data
http://www.nationalatlas.gov/maplayers.html
Jake Benner; Dept. of Geology; Tufts University, Medford, MA

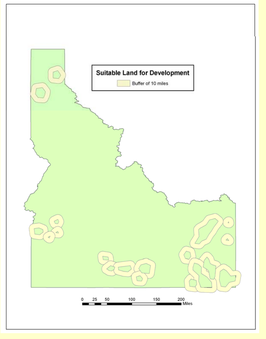
Major population centers and population density was also mapped. Geothermal plant production should be near dense population locations in order to give power to as many people as possible without requiring lengthy transmission runs. This map was converted into a raster image and reclassified to show only locations with high population densities.





However, a geothermal plant should be a safe distance away from the population center. A ten mile buffer was placed around the reclassified locations and then 'donut-holes' were made to show suitable geothermal development areas.



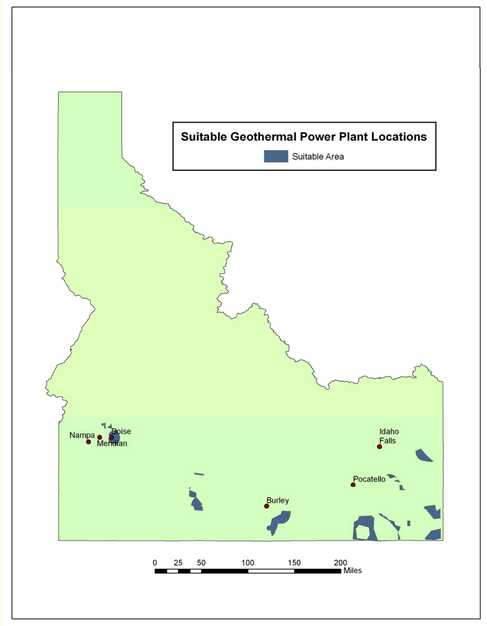


Conclusions

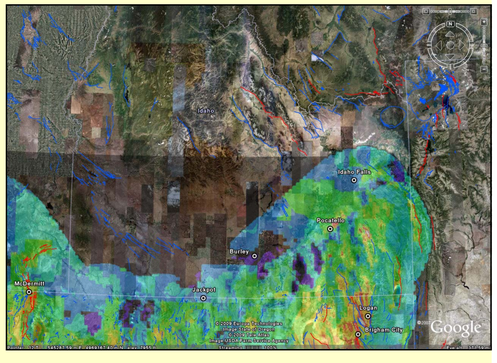
The areas finally selected can be used for further analysis of future geothermal power plant sites in Idaho. Limitations in data include, error in well temperature readings and incomplete population records. Additional data that should be further analyzed includes access to roads, access to constructed transmission lines, locations of faults and fractures, and a subsurface geology analysis.

Results

The final intersection of suitable land from the hot springs and well data and the population data produced the following land areas. There were a total of 15 suitable sites of various sizes.



Compared to the map below produced by the Great Basin Center for Geothermal Energy (red and yellow indicate highly suitable geothermal power plant development sites), the land selected is very similar. This GIS analysis was performed with less data and resources than that of the Great Basin Center but still showed accurate results.



Suitable geothermal power plant sites