Simulative Site Selection For Nuclear Power Plant in Colorado

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GEOL 3050, GIS for Geologists– Prof. Brian Hynek—University of Colorado, Boulder

Map Info: All maps in this poster used WGS 1984 UTM Zone 13N as Geographical Coordinate System and Transverse Mercator projection

INTRODUCTION

Research Topic

Although the fuel that is required by the nuclear reaction is not renewable, it remains one of the only proven ways to generate renewable and carbon-free electricity on a massive scale in near future. However, today's use of nuclear power still is not absolutely safe, natural hazards may cause serious nuclear accidents such as Fukushima Daiichi nuclear disaster. Thus, the location of nuclear power plant is very important.

Goals

- Find the most appropriate location in Colorado for new nuclear power plant.
- The location should be safe enough and could maximize the economic benefit.

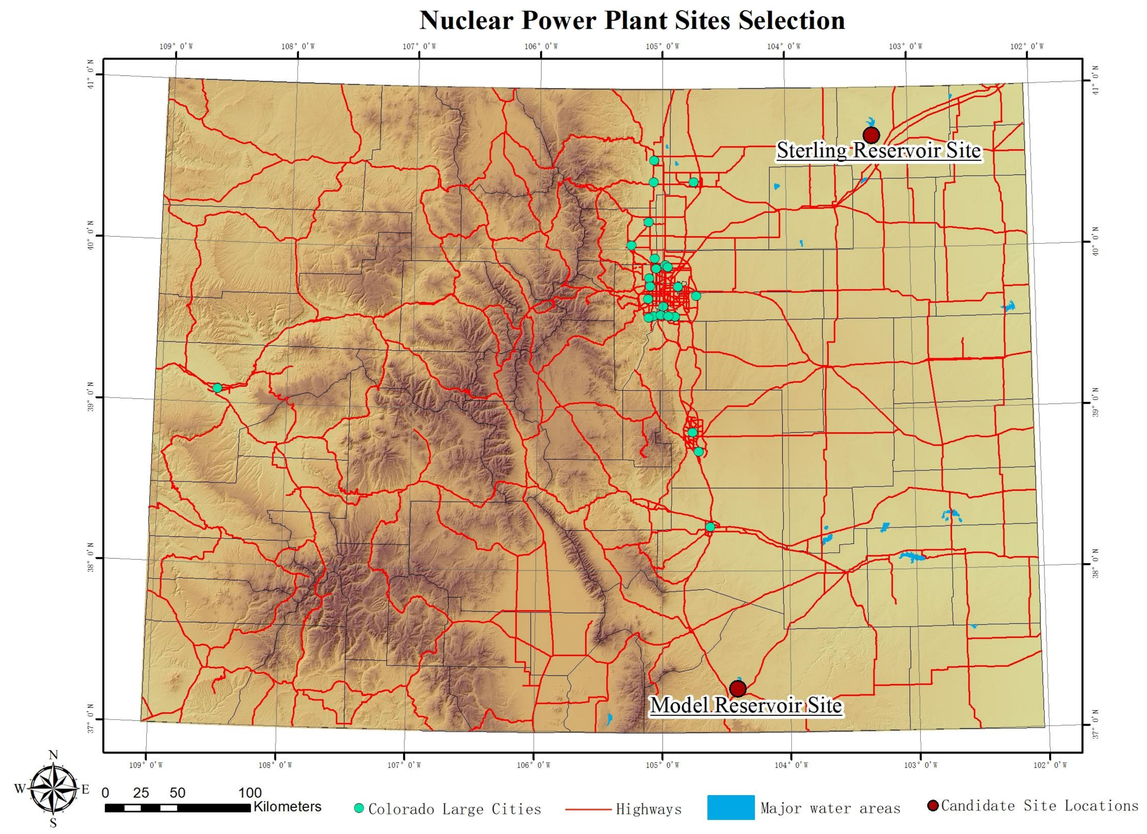
BACKGROUND

- **The risk of natural hazards in Colorado**
  - **Wildfire**
    - One of the most common natural hazard in Colorado, may cause serious damage to the power plant.
  - **Flood**
    - Another common natural disaster in Colorado, also will cause serious damage to the reactor.
- **The relationship between nuclear power plant and cities**
  - Need to located near a middle scale city, because the nuclear power plant need hundreds of workers to operate.
  - Should not located too close to any city with large population.
  - But also should not located too far from major cities, the energy need to be used.
- **Other factors need to be considered**
  - The nuclear power plant need to locate near a large water area such as lake and reservoir, the reactors need lots of water to cool down.
  - The nuclear power plant is better located in plains, it's easier to build. Also could avoid natural hazards such as landslides or rockfalls.

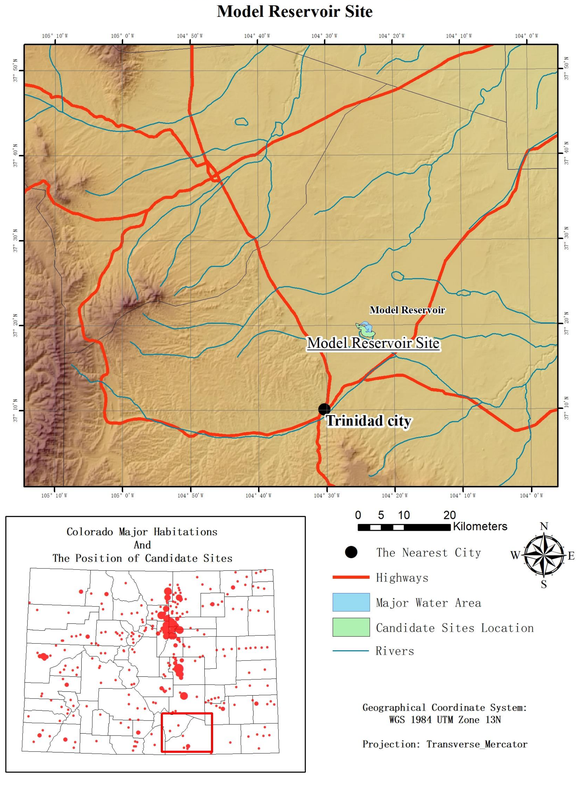
METHODS/CRITERIA

- **The danger zone of natural hazards in Colorado (Wildfire and Flood)**
  - Create 20 km buffer zone around each CO wildfire position from 1980 to 2016
  - Create 1km buffer zone around the floodplain areas.
  - Merge the wildfire buffer with the floodplain buffer as the final danger zone. Nuclear power plant should not be built inside the danger zone.
- **Finding the appropriate cities**
  - Select the CO middle scale cities with population large than 4000, but less than 11000 as the support cities for nuclear power plant.
  - Create a 20km buffer around the selected cities, nuclear power plant should be built inside this buffer.
- **Finding the large cities of Colorado**
  - Select the CO large scale cities with population larger than 20000.
  - Create a buffer larger than 100km but smaller than 150km, the nuclear power plant should be built in this district.
- **Finding the appropriate cooling pond**
  - Select only lake or reservoir with area larger than 3 square kilometers. (No rivers or creeks, avoid the possible floods)
  - Create a 1km buffer around the lakes or reservoirs, nuclear power plant should be built inside this buffer.
- **Finding plains**
  - Find the areas in Colorado with a slope less than 3 degrees by DEM. Nuclear power plant should be built in these areas.

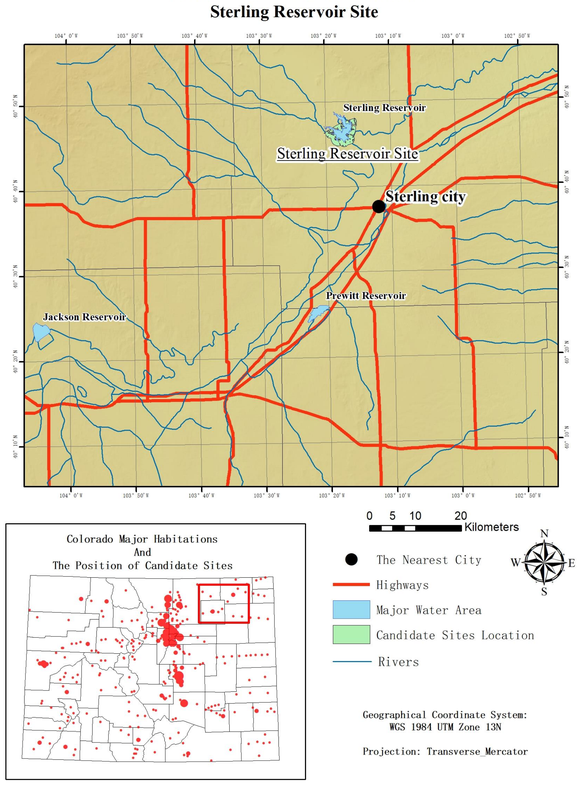
RESULT



Nuclear Power Plant Sites Selection: Model Reservoir Site



Nuclear Power Plant Sites Selection: Sterling Reservoir Site

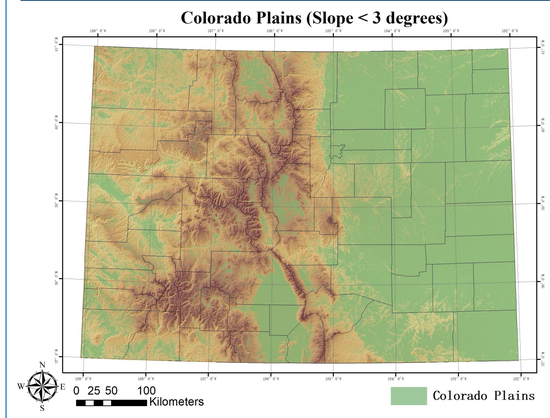


CONCLUSION

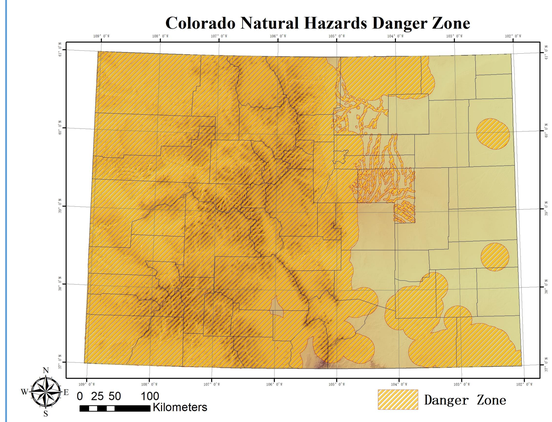
There are only two locations in Colorado that are appropriate to build the new nuclear power plant. The Sterling Reservoir Site locates onshore of Sterling Reservoir, the reservoir has a water area larger than 11 square kilometers, it is near the Sterling in Logan County. The Model Reservoir Site locate onshore of Model Reservoir, the reservoir has a water area larger than 3 square kilometers, it is near the City of Trinidad in Las Animas County. Both two sites are located on the plains and near the highways, easier for construction.

The Sterling Reservoir Site locates in the north region of Colorado, it could provide power for most of the large cities in northern Colorado, including several metropolitan areas, such as Denver–Aurora–Lakewood, Boulder, and Fort Collins. The Model Reservoir Site is located in the south region of Colorado, it could provide power for metropolitan areas such as Pueblo and Springs.

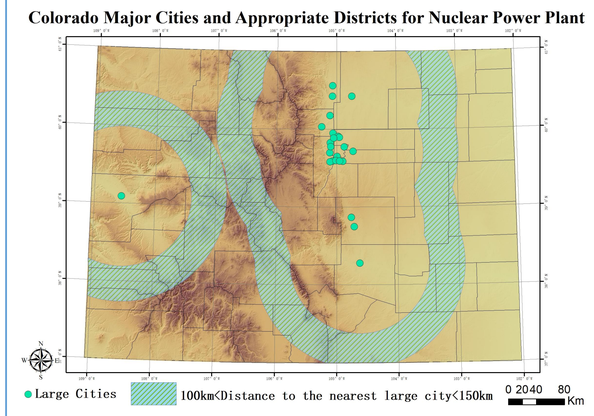
ANALYSIS/DISCUSSION



We could see that most of plains locate in the eastern Colorado. The central and western regions are dominated by mountains.



We could see that most of wildfire and flood only impact the central and western regions of Colorado, the eastern plains are relative safe.



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