

HUMBOLDT STATE UNIVERSITY

Landfill
implementation to
improve the citizen's
quality life of Humboldt
County area.

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1. ABSTRACT

The sanitation in a city is one of the major topics that it has to face. One of the areas in sanitation is the solid waste management, building landfills is the first step to start a city administration. The method to find the best location for the landfill is with the software ArcGIS where all the conditions can be overlap. Doing this areas that are not interesting or do not allow installation are eliminated.

2. INTRODUCTION

2.1 Definition

According to World Health Organization:

"Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and feces. Inadequate sanitation is a major cause of disease worldwide and improving sanitation is known to have a significant beneficial impact on health both in households and across communities. The word 'sanitation' also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal"

In other words, sanitation is a topic that is critical to health, survival and political development. Many countries are challenged in providing adequate sanitation for their citizens, leaving people at risk for water, sanitation, and hygiene. With this in mind, sanitation implemented prevents many health problems, such as Ascariasis (a type of intestinal worm infection), Cholera, Dengue, Schistosomiasis, Leptospirosis, just to cite some of them.

The sanitation is divided in four segments:

- Wastewater treatment;
- Storm water drainage;
- Solid waste management and;
- Water treatment.

The focus of this project is to create a solid waste management, this means defining a potential site for constructing a landfill plant in Humboldt County area. Find an appropriate area for the disposal of solid waste is very important to the community. A landfill deployed in the correct location, and then constructed correctly, can enhance

the life quality of a region. Therefore decreases diseases, generates a more pleasant environment for citizens, and offer protection to natural environment.

2.2 Law foundation

Municipal solid waste landfills receive household waste, and can be prepared to receive other kinds of materials/waste, like industrial, hospital, etc. This kind of waste must comply with the federal regulations in 40 CFR Part 258. The federal standards include location restrictions ensure that landfills are built at safe distances from (below are listed the main topics):

- in airport safety areas;
- wetlands;
- river distance;
- access to roads;
- seismic areas;

3. METHODS

The potential site for constructing a landfill in Humboldt County was determined by the creation of a map in the ArcMap program. To find this site, all the data required by according to federal regulations, as it was mentioned before, has been downloaded from the Humboldt County GIS website. Additional California natural layer has been obtained from Free U.S State Shapefile website. First, all the data has been checked to see if it was properly georeferenced and the projection was defined by the Project tool. Furthermore, GIS tools, such as Clip, Buffer and Erase, have been used in each layer to find the location restrictions to build a landfill.

As already mentioned it follows from what is said based on the federal law 40 CFR Part 258. But for the purpose of this project some location restrictions are not detailed in that, so a Brazilian reference and an estimated value were used due to the need to adequate. The table below shows the law standard, such as all the considerations that were made.

Table 1 - Restrictions table.

Feature	Restriction
Airports	Far for at least 8 kilometers
Roads	Easy access – considered a ratio of 1 km
Wetland	Outside these areas
Seismic area	Outside these areas
River	Far for at least 200 meters
Forest	Outside these areas
Cities	Far for at least 2 km

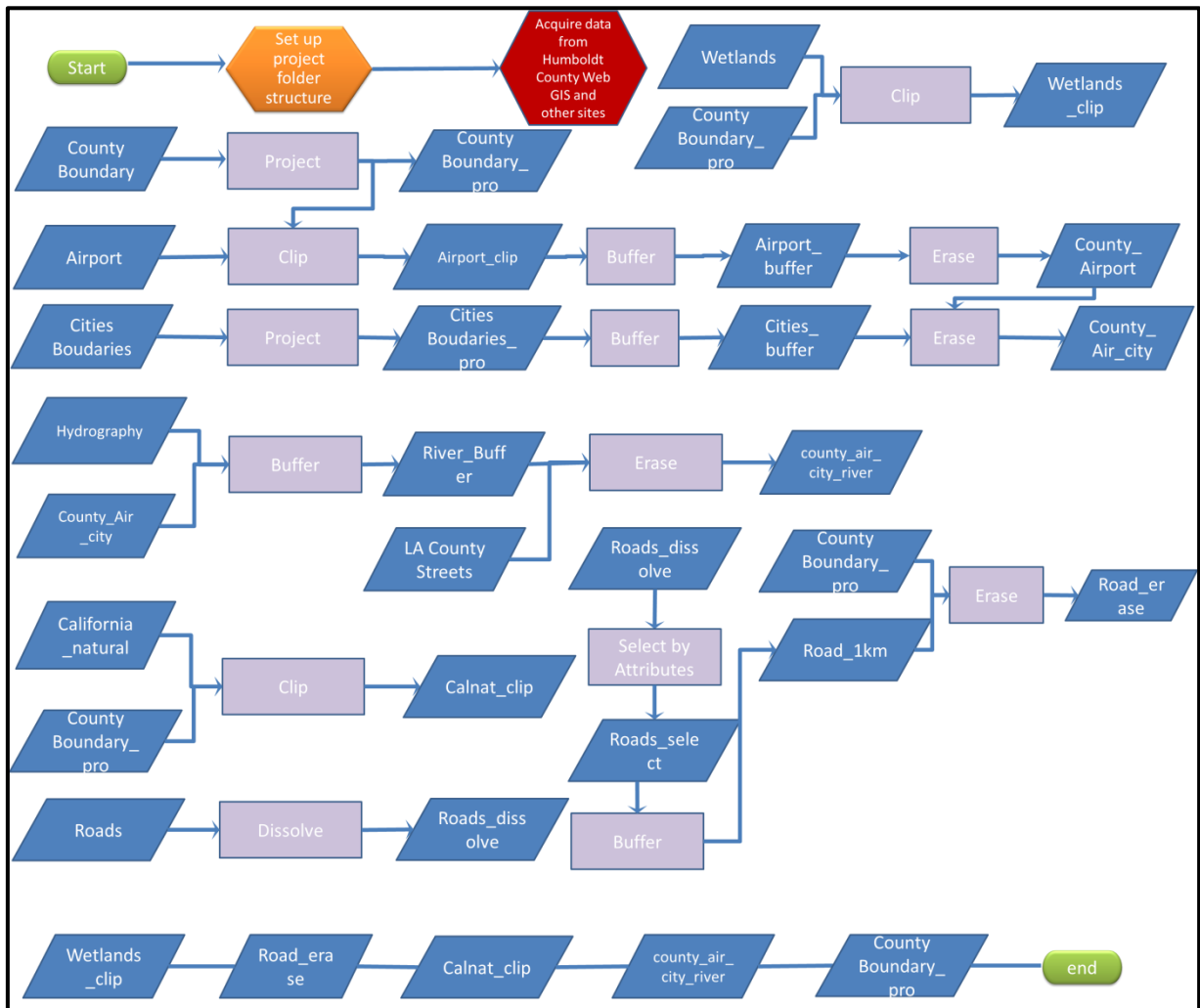


Figure 1 – Flowchart of methods

4. RESULTS/DISCUSSION

Following the methods previously presented the following maps were obtained.

In the map below, it is possible to see that the landfill should be located away from urban centers, as these present great risks. Risks are present in our project, since there's great amount of wetlands, and seismic areas. With this in mind, the place that was found is suitable since it's located in an area that can more effectively support the cities of county and also neighboring counties.



Figure 1 – Locator map.

It's important to say that for this project it was considered only a few factors that go into the construction and management of a landfill. Although, there are other variables that may further restrict the area as relief (slope), soil structure, and the soil classification in the region.

Below, the objective is showing how the steps of our project developed. After that, some steps were merged in one map and others in more than two steps. The

explanation of the merge is due to a better view and understanding of the map.

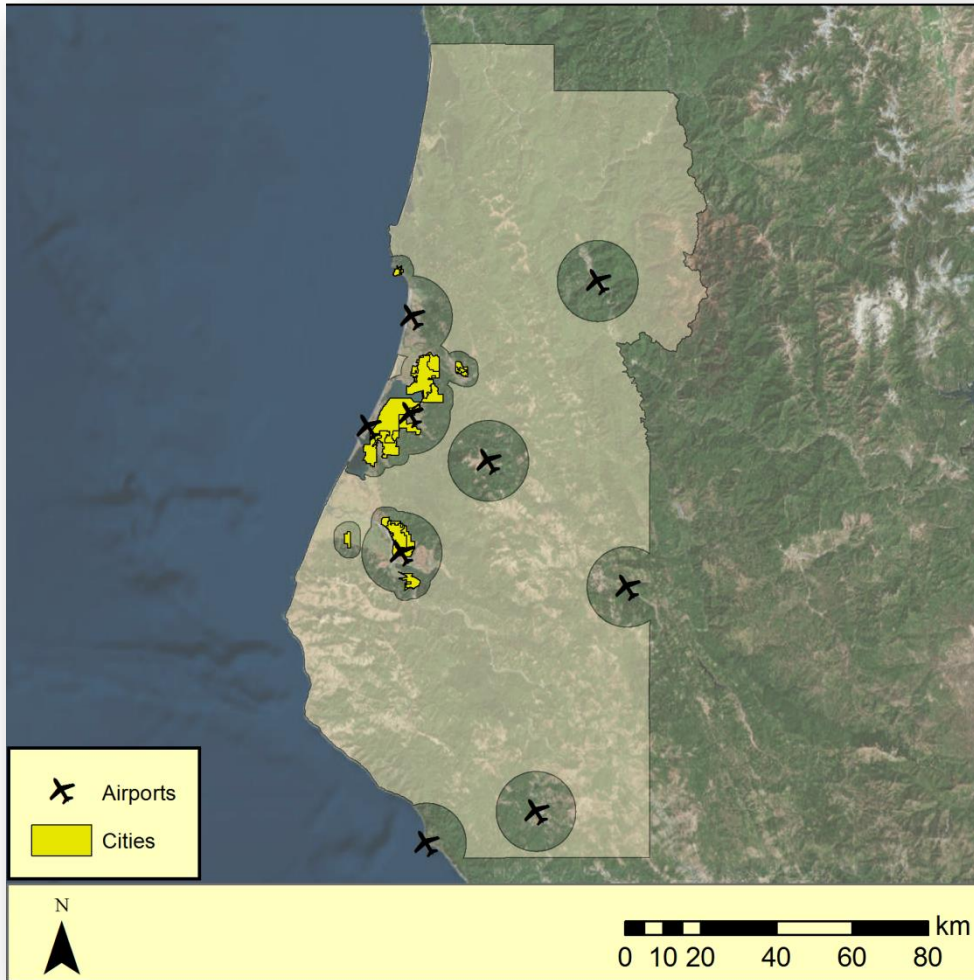


Figure 2 – Airports and cities buffer map

The map above shows two steps previously described in the methods section: airport and cities buffer. In this direction, the buffer consisted in finding the regions where the landfill could not be placed. Major cities and known airports were inserted in data, and the buffer (8 kilometers for airports; 2 kilometers for cities).

Moreover, it is always important to remember the county boundary data, that it was added at this point.

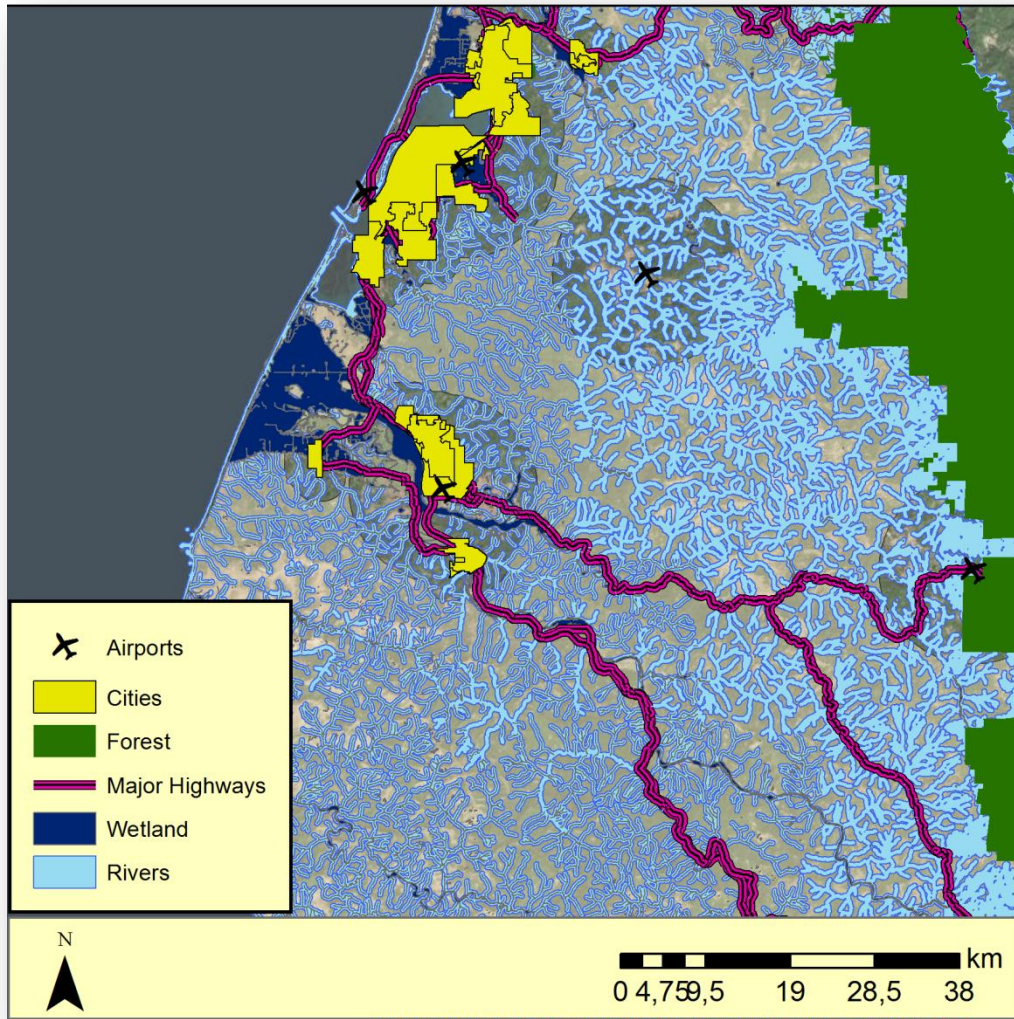


Figure 3 – Map including forest, major highways, wetland and rivers

Between this map (Figure 3) and the previous (Figure 2), native forest, wetlands and rivers were added to our project. About the roads, the group assumed that the most important roads for landfills were the major highways, connecting important cities in Humboldt County through fast and wide roads. In this direction, we used the ArcMAP tool “Select by Attributes” to filter the major highways. In this step, the map is a little confused, since there’s many different data in it – the final step would clarify more, finding the ultimate map.

After this step, by analyzing the map above, it’s possible to visually find adequate places to build a landfill.

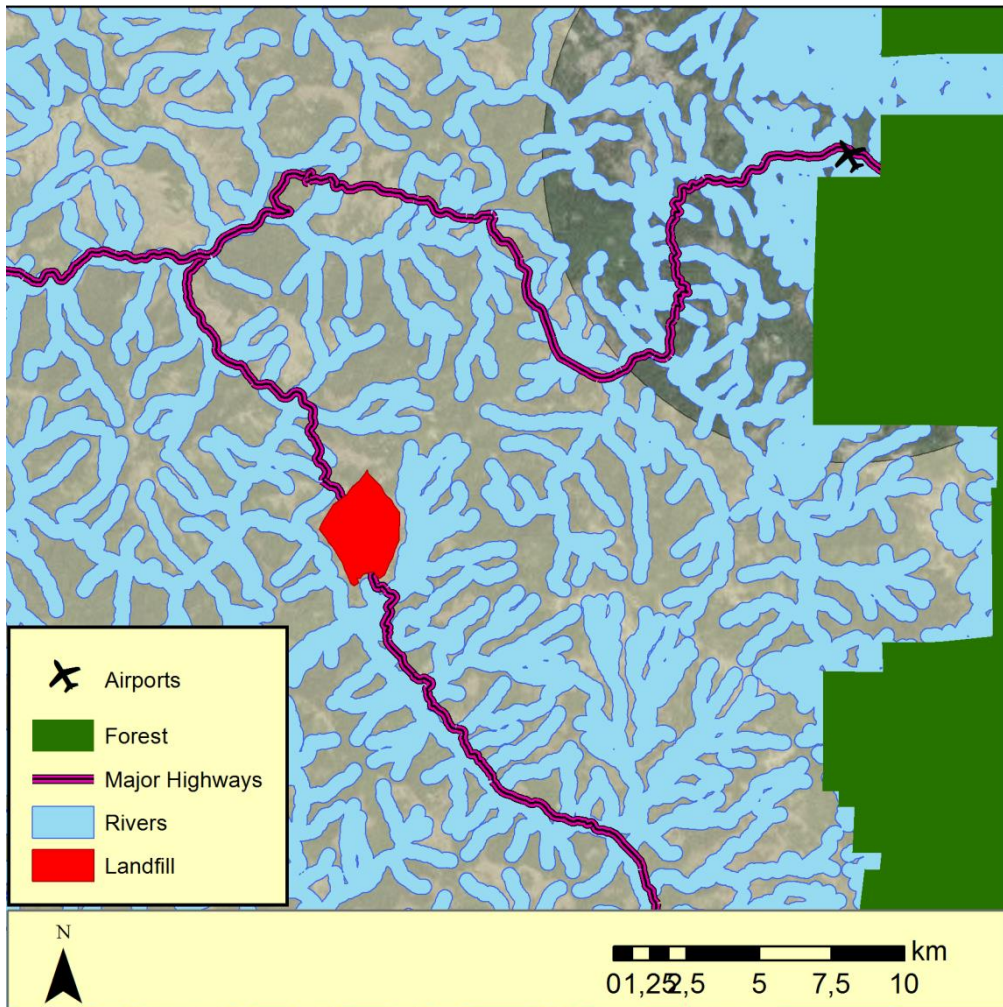


Figure 4 – Airports and cities buffer map

Above, the final map is shown in figure 4, and in red, the zone which a landfill can be implemented with an area of 3.825234 Km².

Landfills in general differ a lot in terms of area occupied in land. Its area can range from 1km² to 4 km² and more than that. Making an average of these areas and using 2.5 km² for a landfill, it could be placed and fit well. The proper zone for the landfill implementation was visually found – away from big urban cities, rivers, wetlands, airports, native forest and close to major highways. It could bring new jobs, better management and treatment of solid waste of Humboldt County and neighboring cities.

5. CONCLUSION

The final area that was found is big enough to build a landfill that can assist the cities at Humboldt County, and also other counties, when working together with the existing landfills.

After making this project we could realize the importance of a good study area before any structural implementation. The tools software ArcGIS offers were of great importance for the analysis, being possible to realize spatially and visually the best location of a landfill.

Finally the project was also important to understand how careful should the preparation be for the implementation of a landfill. In the work presented some criteria was considered for its construction. At last, it is important to consider and remember that the analyses of soil, reliefs, among others, are of most importance in projects like this, where risks as contamination of soil, groundwater, springs of rivers, forests, i.e. a major environmental risk.

6. ACKNOWLEDGMENT

We would like to thank Dr. James Graham and also the Professor Nicholas R. Malloy for their support in this project process.

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