

GIS-based Site Suitability Analysis: Case Study for Professional College in Dehradun

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Abstract—*Geographical Information System (GIS) and Multi Criteria Evaluation (MCE) are the standard techniques used to examine the possible sites for development in urbanization of an area. The most important issue for a developing a city is the identification of proper locations for urban development. Site suitability is a way for understanding the existing site locations and also the elements that will help to decide the sites for a certain activity. This paper explains the usage of GIS and MCE techniques for selection of most appropriate sites for developing a new professional college in the city of Dehradun, Uttarakhand. For this cause, Topo-sheet and satellite data has been used to produce different thematic layers by using software like ArcGIS. Criteria using connectivity of roads but away from highways, away from major residential areas but not far from city, land use/land cover, land proximity and other geographical information has been used for the analysis of the suitable site by properly evaluating the land. By measuring each criterion according to the importance, certain weights of each criterion is created. These weights and maps has been combined using ArcGIS tools and the final map was prepared showing the suitable sites.*

1. INTRODUCTION

Urban development and migration of people from rural areas to urban areas has been a global phenomenon. The conversion of natural land into urban usability service is obvious due to the change of the rural centers into metropolitan cities (Hauser et al., 1982). Identifying a suitable site for development of an urban area is one of the most appraising task of planning. Site suitability is the technique to understand the quality of an existing site and also the factors that determine the location for an activity. This technique consists of detailed investigation of the land cover and also the ongoing processes of the site, that characterize it. The processes include the mapping approaches by means of GIS tools, which help in processing the geodatabase and thus help in various planning objectives and its alternative usage (Kumar et al., 2014). The practice to undertake the work of locating an optimal site for the intended project such as new college, a new apartment site or a new bus station is the usual task of a group of individuals or institutions. The factors required to find an optimal solution for any job to be undertaken like land use, type of soil, slope of the land and other applicable factors affecting the solution. The outcome of a site suitability analysis is a complete display

of the optimum suitable areas of consideration for a certain facility, while removing the unsuitable or undesired sites. Certain facets are of higher importance in determining the solution for a facility in comparison to others. The process of selecting a suitable area for some specific purposes should be based on an exercise set of criteria based on the selected norms. The process of overall suitability for a certain urban use can be obtained by using a weighted system of the various aspects. GIS applications offer approaches which can facilitate easy and faster remodeling of small changes for a criteria to produce results in the form of maps for presentation (Parker, 1996). GIS tools allow users to get the results by forming geospatial queries on the spatial information and edit the data obtained to form maps to present the outputs of all the operations. These techniques of site suitability require measurements that are to be regenerated to values that are common and are to be converted to ease out the final selection of the site (Bunruamkaew et al., 2011). This technical work intends to describe and explain the need of professional colleges in a capital city like Dehradun, and the challenges faced to set up in the areas to be preferred for setting up the professional colleges.

2. CHALLENGES

The module works with the challenges faced in setting up of professional colleges in the city of Dehradun, which is the capital of Uttarakhand state of India. For the above need, the sites are to be found out which are suitable for setting up of colleges. The challenges faced are like:

- a) Good connectivity via roads.
- b) Proper college area for setting up buildings as well as playgrounds.
- c) Preferably, away from residential areas and existing professional colleges.
- d) Away from highways and major roads, to avoid accidents.
- e) Should not be far from the main city.

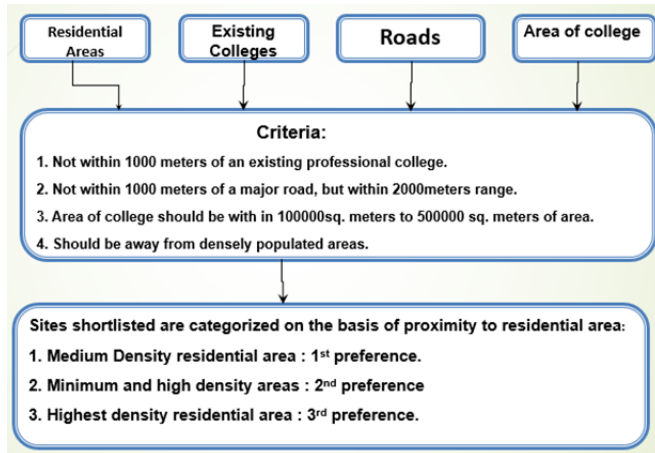


Fig. 2: Flow chart for Site Suitability Analysis

Different maps according to the criteria were changed into raster data format, as it is less cumbersome than vector data format (Chang, 2010).

To get the final site suitability map, these classified raster data maps were processed in the raster calculator of ArcGIS tool and the weights were multiplied accordingly.

5. RESULTS AND DISCUSSIONS

The site suitability analysis for Professional college’s criteria that are effective as follows:

Proximity of roads:

Road is a very important criteria in site suitability as the need of transportation and connectivity mainly relies on the road network within a city. So, efforts are taken to make the site closure to the road. And, also to avoid accidents buffer zone of 1000 m has been taken into consideration. But, also to check the connectivity the buffer zone of 2000 m have been checked to make the site closure to the main roads. Fig. 3, shows the buffer zones of the roads.

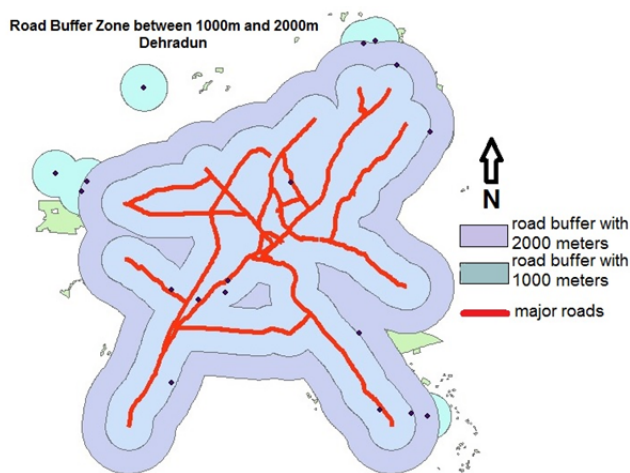


Fig. 3: Road proximity buffer zones

Existing land use:

The land use includes all the exiting professional colleges in Dehradun. This is also a very important criteria as two professional near to each other may lead into many situations that may not be favourable. So, a buffer of 1000m is taken into consideration for the existing professional colleges. Fig. 4. Shows the buffer zone of the professional colleges.

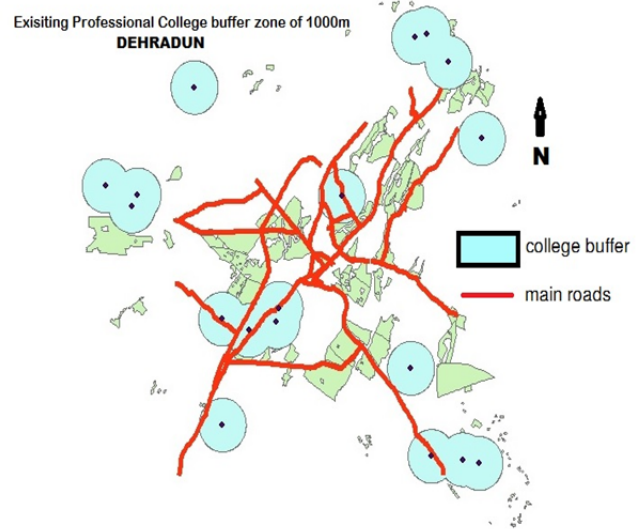


Fig. 4: Professional College Buffer zone

Population density of the area:

Land use and land cover is also a major criteria for selecting a site for a professional college. As, a college cannot be in a place where its reserve forest or near forest or places where there is high density of population. So, by keeping all these criteria in mind, a medium density area is selected. The buffer zone shown in fig.5.show the areas of Dehradun where it is medium dense.

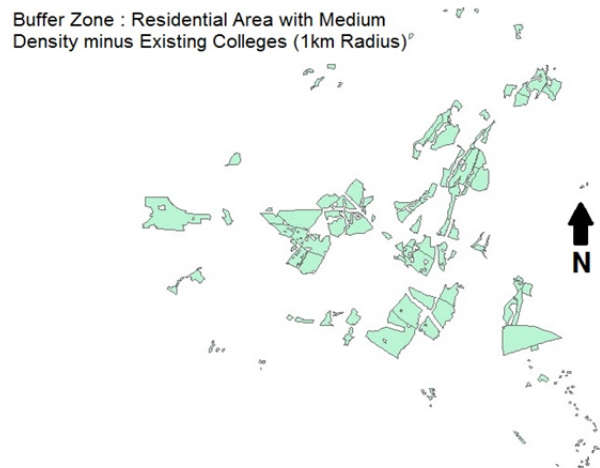


Fig. 5: Shows the areas of medium density without the existing colleges.

Geological formation of the land:

The geological formation of a site is also very important, as the texture and type of the soil is important for finding a site for its usability. The probable site for a professional college needs buildings as well as playground, so the size of the site should be big. The soil types around Dehradun are of Alluvium or Piedmont Fan Deposits. The characteristics of the soil is deep, well-drained and coarse loamy cover over fragmental soils (Central Ground Water Board, 2011). So, the structure and total area of the site is very important and buffer zones showing the probable site for the professional college in proximity with the major roads but without the area constraints is shown in fig. 6.

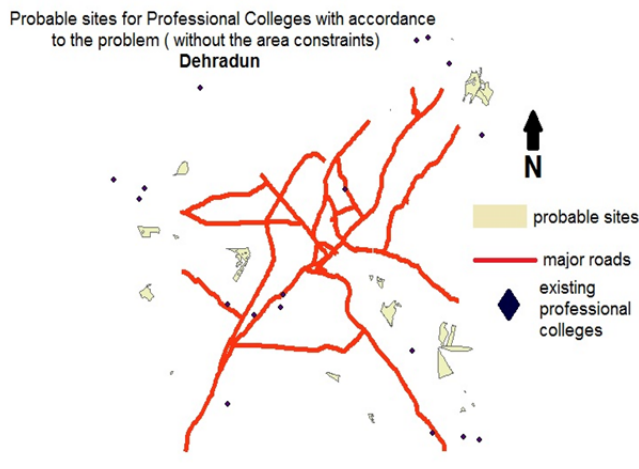


Fig. 6: Shows the probable sites for Professional Colleges

The final map showing the suitable sites shows that the concerned study area consists of 13 suitable sites for the construction of professional college with the area in between 100000 sq. meters and 500000 sq. meters.

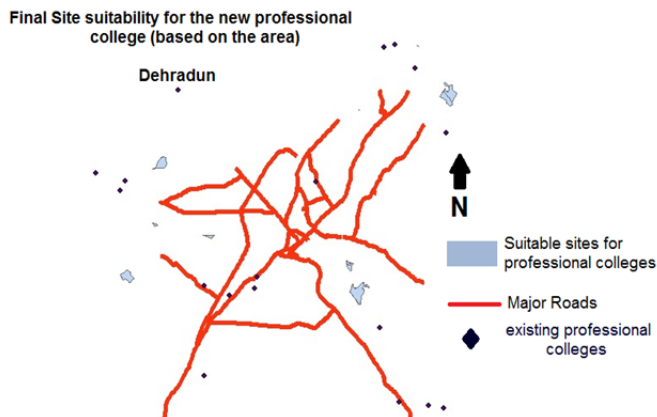


Fig. 7: Final site suitability map of Dehradun city for Professional Colleges.

6. CONCLUSIONS AND LIMITATIONS

Land use suitability analysis for the development of an urban area is necessary to sustain the problem of continuous migration to cities with a limited availability of land. The Multicriteria evaluation process based on GIS is very easy and helpful which analyzes various suitability criteria of Dehradun city and also the database of land suitable for the development of the city for any specific job.

As per the suitability map, the area of the north-east region and the area in the center of the map, are near two major roads, so they are more suitable than the other suitable sites.

This model can be used in public usage for urban decision making and development process. This will assist many planners and organizations to make plans for sustainable development of the region. This outputs can be further integrated with the information technology hub for better job prospect of the students, as the industrial belt can be built around the suitable sites.

The only limitation for this kind of model for site suitability is that, it requires an intensive field survey for getting the current locations of the concerned land use and also for mapping a very high resolution imagery of the study area is needed.

7. ACKNOWLEDGEMENTS

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