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Site Suitability Analysis for Urban Development: A Review

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Abstract: Geographical Information System (GIS) and Multi Criteria Evaluation (MCE) are the most common techniques used to analyze the potential sites for urban development. These techniques are very simple and flexible for the analysis process. The paper is basically a review of site suitability analysis for urban development. Over the past decade, a significant amount of research has been conducted for finding the suitability of site. Different authors have used various techniques for the land suitability. ArcGIS software were used to analyze different thematic layers for finding suitable areas, for this purpose satellite data were used for creating various layers. Various factors were identified for criteria evaluation. By comparing each factor according to their importance, weights of each factor is generated. Criteria weights and maps were combined using ArcGIS tools. With the help of weights and criteria final suitability map were prepared.

Keyword: *Geographical Information System, Multi Criteria Evaluation, ArcGIS*

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I. INTRODUCTION

Site suitability is the method of understanding existing site qualities and factors that will determine the location for a particular activity. It involves the detailed investigation of the natural resources and processes that characterize a site and include mapping techniques including GIS tools that help in processing the geographical database that display the areas of the site, suitable for various planning objectives and alternatives[2].It is the usual practice of individuals, institutions and organizations to undertake the task of searching for the optimal site for their intended project such as new school, a new bus terminus or a new airport. Intensive study of a large number of maps containing data about land use, geology, geomorphology, slope, soil type, land ownership and other relevant factors which is important to find an optimum solution to any given problem.GIS techniques offer an alternative approach which facilitates quick and easy remodeling for slight changes in sitting criteria, and produces results as maps suitable for analysis and presentation [4].Geographical Information System is a system designed to capture, store, manipulate, analyze, manage and present all types of spatial or geographical data.GIS applications are tools that allow users to create interactive queries, analyze spatial information, edit data in maps and present the results of all these operation. Geographic information science is the science underlying geographic concepts, application and systems.GIS is a broad term that can refer to a number of different technologies, process and methods. It is attached to many operations and has much application related to engineering, planning, management, transport, insurance, telecommunication and business. The results of these analyses can greatly reduce the time and effort, which might otherwise be spent manually searching records, processing data or field surveying. Site location is a key factor and initial step in the design of many projects. Acquiring new site for urban development is increasingly more challenging particularly in an increasing real estate market and can be the result of growth of urban areas, and increased environmental standards or regulations. The results of the site suitability analysis produce a detailed display of the most suitable to least suitable areas for consideration of placement of a certain facility, while filtering out unusable or less desirable sites. Certain aspects are more important than others in determining the best location for each site, and might include an areas proximity to existing infrastructure, soil types, and slope. These site suitability analyses require unlike measurements to be converted to common values that can be summed and compared to ease the final site selection process [5].

II. LITERATURE SURVEY

Different authors have used various technique and factors for selecting suitable sites for urban development.

2.1. Santosh Kumar, Ritesh Kumar (2014) "Site Suitability Analysis for Urban development of a hill Town using GIS Based Multicriteria Evaluation Technique: A Case study of Nahan Town, Himachal Pradesh, India [2]: In this paper author tries to identify the potential site for urban development. The author has selected Nahan town as the study area. Here the author has selected six criteria namely slope, road proximity, land use, land values, soil and geomorphology for the land evaluation. The study attempts to introduce decision support system

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used for site suitability analysis. Geographic Information System (GIS) and numerical based methodology has been applied to select suitable sites for urban development. For this purpose, various thematic layers such as slope, road proximity, land use/land cover (LU/LC), land values, soil and geomorphology maps have been generated in ArcGIS 9.3. Internal weights were assigned to each layer with values ranging from 0 to 8 under attribute field weight. Each vector layers were rasterized by taking weight as a feature class. Water bodies, forest, residential, recreational, commercial and industrial were assigned zero weights [2]. Higher weight was given to vacant/ open lands with slopes less than 15 percent and buffer factors for roads are considered. Using these thematic layers as factors, criteria map was generated by applying Spatial Analytic Hierarchy Process .Suitability classes were classified as very low suitable, low suitable, moderately suitable, high suitable, very high suitable. Highly suitable areas for urban development is either agricultural or forest type and the low suitable areas is mostly residential. This study performs a GIS Spatial analysis in which models are represented as a set of spatial processes, such as buffer, classification, and reclassification and overlay techniques. The result is summed up producing a site suitability map as shown by the formula;

Site Suitability= Σ [factor map (Cn) x weight (Wn)]

Where, Cn=standardized raster cell

Wn=weight derived from AHP pair wise comparison

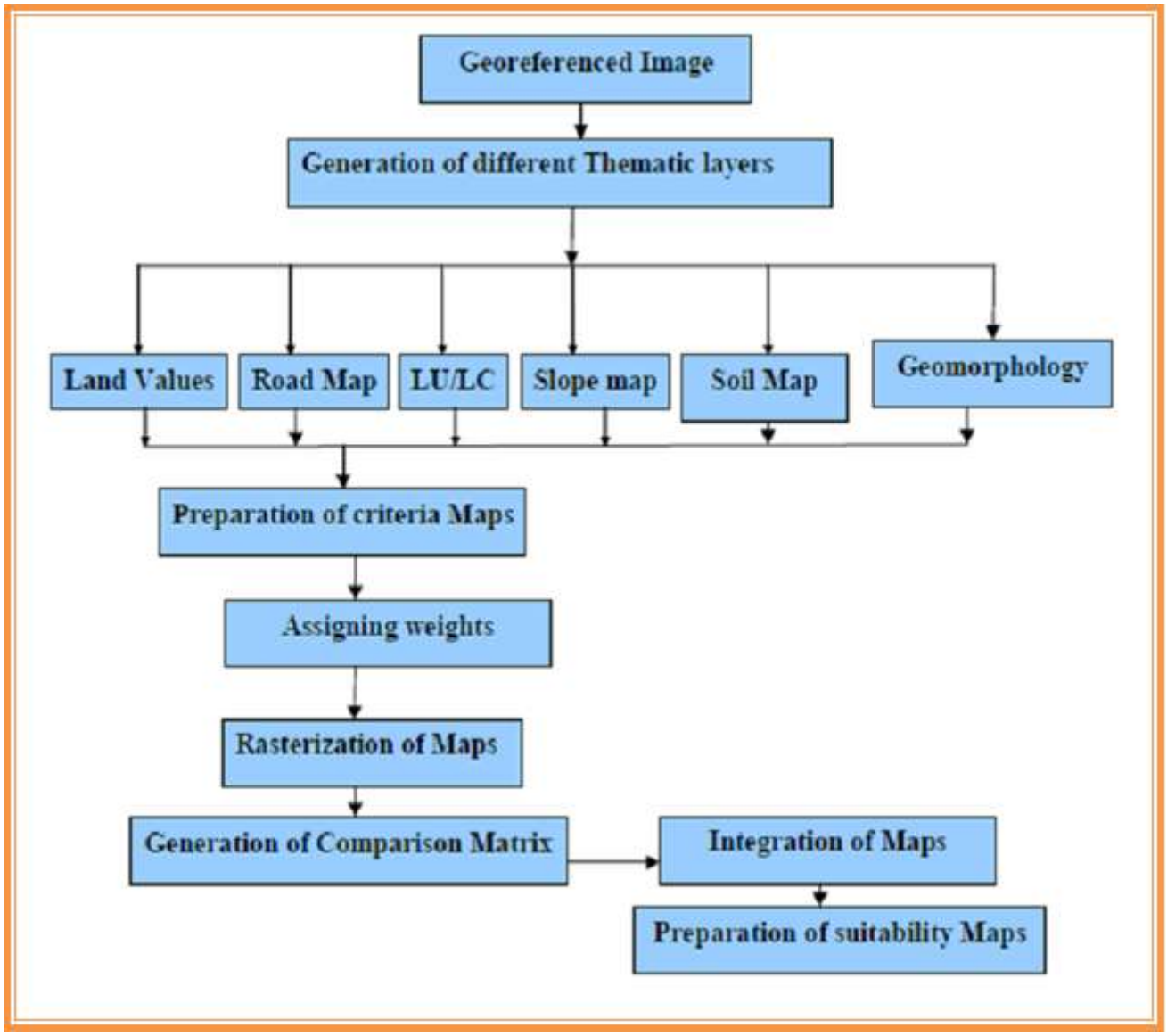

Fig.1.Flow chart for Site Suitability Analysis[2]

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The study area is located in hilly terrain and covers an area of 3.6sq.km. After suitability analysis it was found that from the available area 0.1157 sq. km falls under very low suitable, 1.6835 sq.km under low suitable, 1.2090 sq.km under moderately suitable, 0.3663 sq.km under high suitable and 0.1248 sq.km under very high suitable. The result shows that highly suitable areas for urban development is either agricultural or forest type and the low suitable areas is mostly residential.

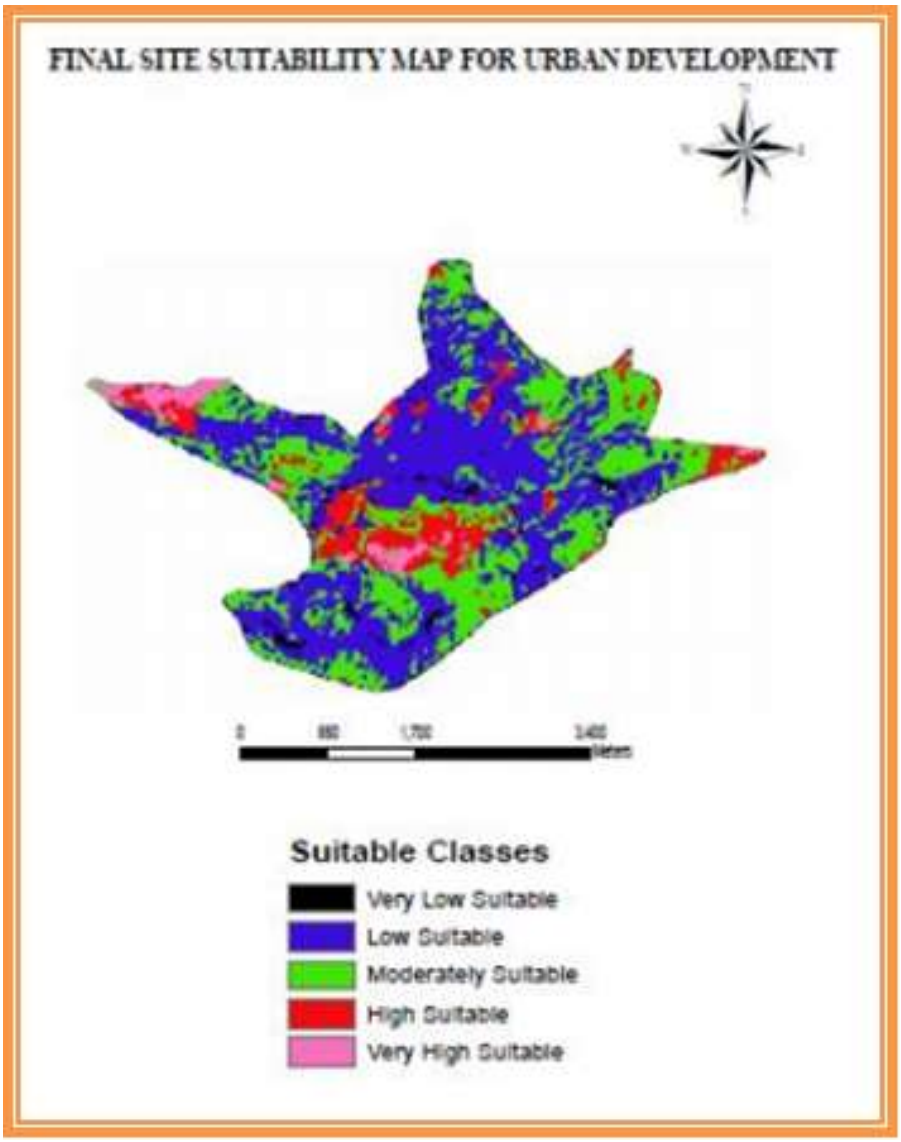

Fig.2. Site Suitability for development of Nahan[2]

2.2. Manish Kumar, Vivekananda Biswas (2013) "Identification of Potential Sites for Urban Development Using GIS Based Multi Criteria Evaluation Technique: A Case Study of Shimla Municipal Area, Shimla District, Himachal Pradesh, India" [1]: The author of the paper tries to locate the suitable site for urban development, considering Shimla as the study area. In this paper the author have considered geographical information system as one of the most important technique for selecting suitable sites for urban development in Shimla district, Himachal Pradesh. Five criteria were selected namely slope, road proximity, land use, aspect and lithology for land evaluation. The generated maps of these criteria were standardized using pairwise comparison matrix known as analytical hierarchy process (AHP) [1].

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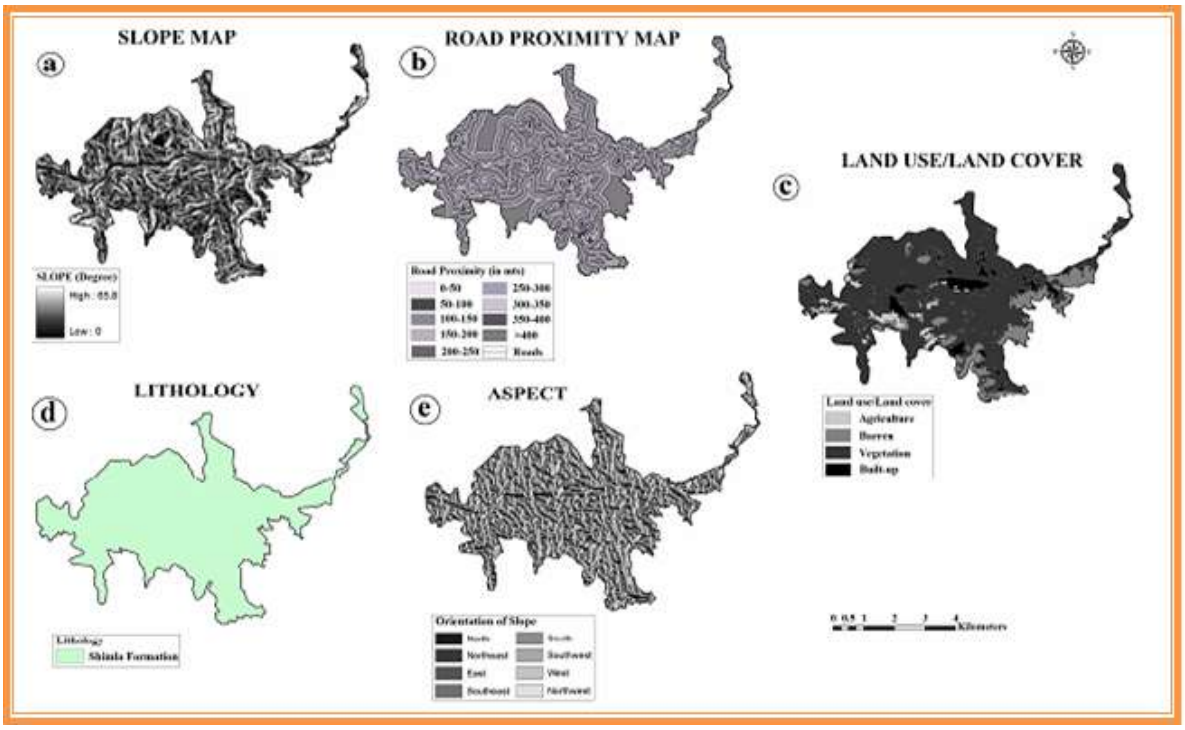

Fig.3. (a) slope (b) road proximity(c) land use (d) lithology (e) aspect [1]

All five criteria maps were converted into raster format, so that for each pixel, a score can be determined. All the criteria maps were integrated and overlaid and the final site suitability map was prepared by the following formula:

Suitability map= Σ [criteria map * weight]

The final site suitability map reveals that the study area was divided into six different suitability categories. The area under extreme low, very low, low, moderate, high and very high lands stand at 4.95 km ², 2.8 km², 1.18 km², 7.23 km², 3.74 km² and 7.68 km ²[1]

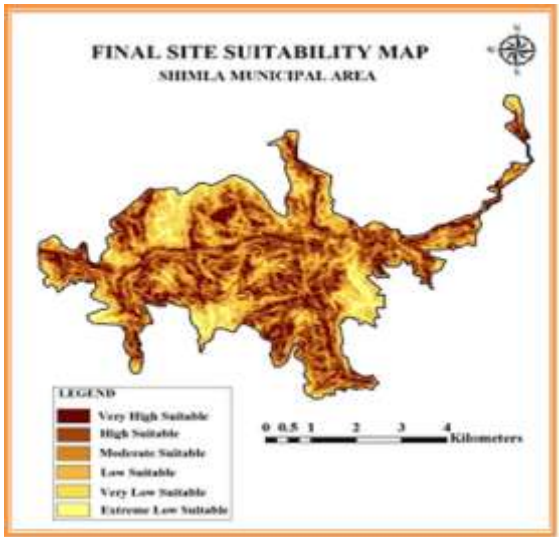

Fig.4.Final suitability Map [1]

III. CONCLUSION

Site Suitability analysis for urban development can overcome the problem of limited available land with respect to drastic urbanization.The GIS based multicriteria evaluation technique is very simple fexible which can be used to analyze the various suitability of a hilly area.

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