SHORT COMMUINICATION

GIS-based Analysis for Optimal Site Selection of Schools in Tehsil Khushab, Punjab

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Introduction

Education plays an important role in the development of society. The service area for schools is generally considered at a distance coverd in 10 minute walk. There are four tehsils of Khushab which are Khushab, Nurpur Thal, Quaidabad and Noushera. There are some areas with no government schools for girls. In previous research works serviceability has been analyzed with indices such as number of schools (Mladenka and Hill, 1997; Omer, 2006), but these indices do not show the correct results (Ohio and S.Jiong, 2007). However, it is difficult to find serviceability without analyzing the spread of schools (Tsou, 2005). This study focuses on the spatial spread of schools and the accessibility of people to schools integrated with the road network. Accessibility is the basic facility, which helps people move anywhere and reach destinations (Gregory, 2009). It is also considered the proximity of one place to another (Pooler, 1995).

Materials and Methods

Study Area: Khushab is located at 33.2855° North and 71.3488° East, between Sahiwal and Muzaffargarh. It is situated in near the Jhelum river. A large shore of Khushab is made up of agricultural features. The spatial extent of Khushab is around 6623 sq.km but the area is still expanding day by day. In 2018 Pakistan Bureau of Statistics concluded that the population of Khushab is 1372882.

1) Road Network

To develop error-free road network data set, node topology has been implemented and network analysis has been performed with the help of the formula as given below.

S=v x t

S= Length of road

V= Travel Speed

T= Time

2) GIS Analysis: Schools Accessibility

Service area analysis has been performed keeping all attributes i.e. time, distance and cost. A service area of 5 minutes has been carried out which contains all streets which can be travelled within 5 to 10 minutes. Different accessibility zones (0 to 5 minutes, 5 to 10 minutes) have been considered in the service area.

Served Area and Population

Served area is measured with the integration of different shapefiles of different criteria in ArcGIS. Served population is found with the help of the following mathematical algorithm.

Served population= (Total Population of Tehsil) / (Total Area of Tehsil)

Results and Discussion

The road network was divided into subcategories which consist of primary, secondary, tertiary roads. Road network data set has been obtained with the help of network analysis in which F node, T node, F and T mint and one-way prohibition attributes are incorporated. Land use data have been obtained from the USGS Landsat image, while the land use classification was made through image classification in ArcMap.

|	LANDUSE	SERVED AREA	POP DENSITY	ROAD	SLOPE	Multiplication	NTH ROOT	PV
LANDUSE	1.00	4.00	3.00	2.00	7.00	168.000	2.787	0.4448
SERVED AREA	0.25	1.00	0.33	2.00	5.00	0.833	0.964	0.1539
POP DENSITY	0.33	3.00	1.00	2.00	2.00	4.000	1.320	0.2106
ROAD	0.50	0.50	0.50	1.00	4.00	0.500	0.871	0.1390
SLOPE	0.14	0.20	0.50	0.25	1.00	0.004	0.324	0.0517
SUM	2.23	8.70	5.33	7.25	19.00		6.2647864	1
SUM*PV	0.99	1.34	1.12	1.01	0.98	5.4426425		
LAMBDA MAX	5.44							
CONS INDEX (LMAX - N)/(N-1)	0.110661							
CONS RATIO	0.098804							

Fig. 1 Analytical hierarchy process technique.
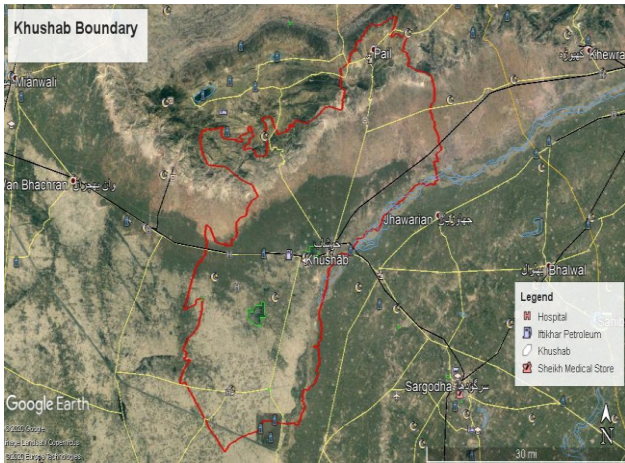
Fig. 2 Khushab tehsil spatial extent.
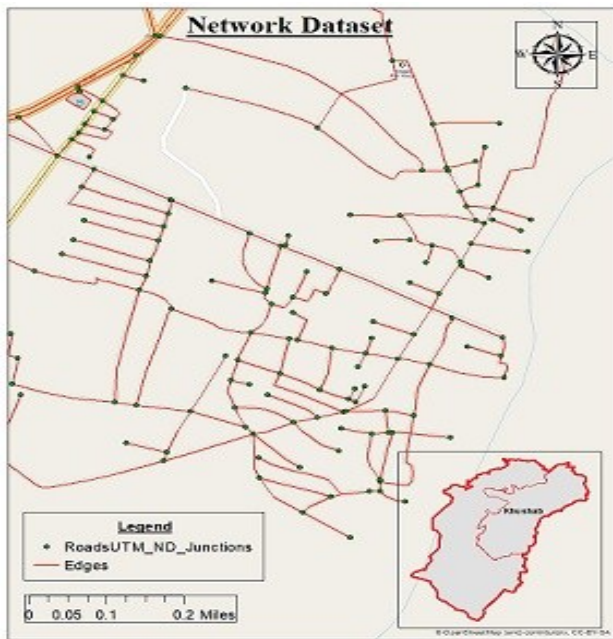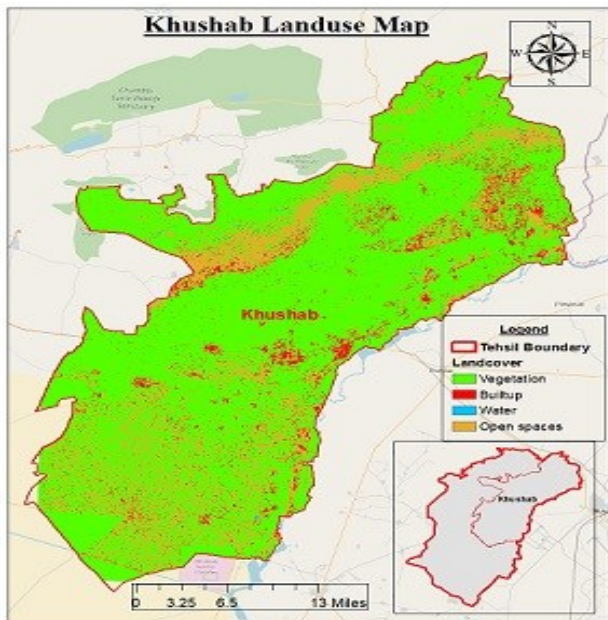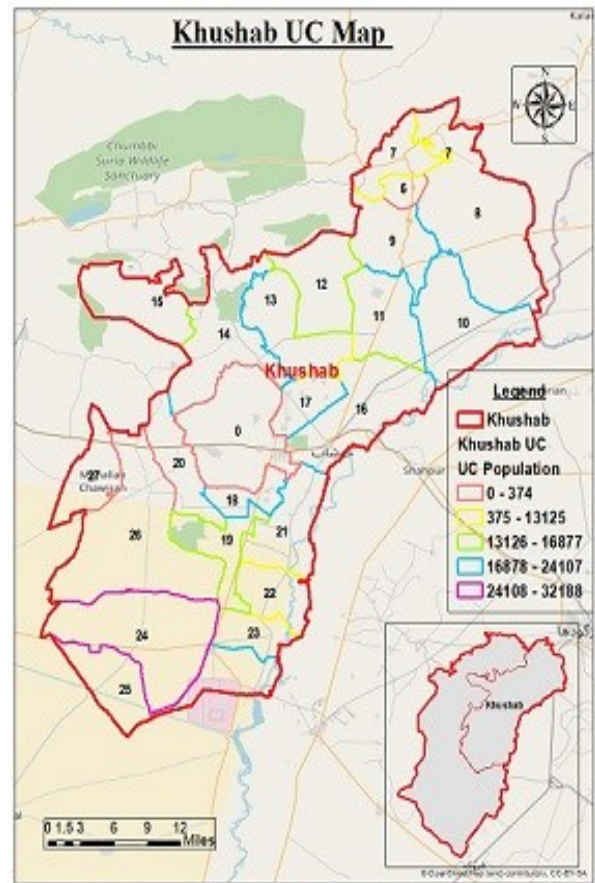

Fig. 3 Road network dataset.

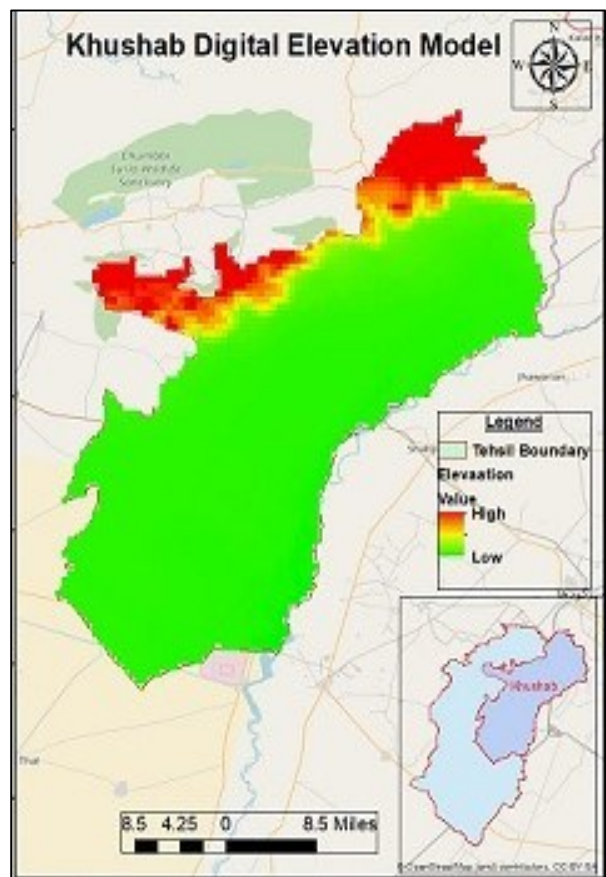Fig. 5 Khushab UC boundary map.

Fig. 4 Khushab landuse map
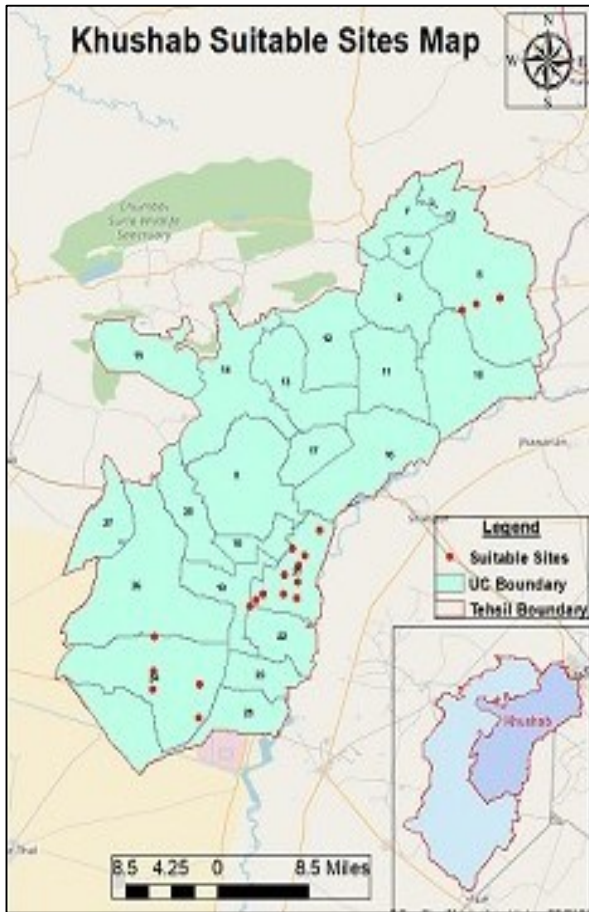

Fig. 6 Khushab DEM.
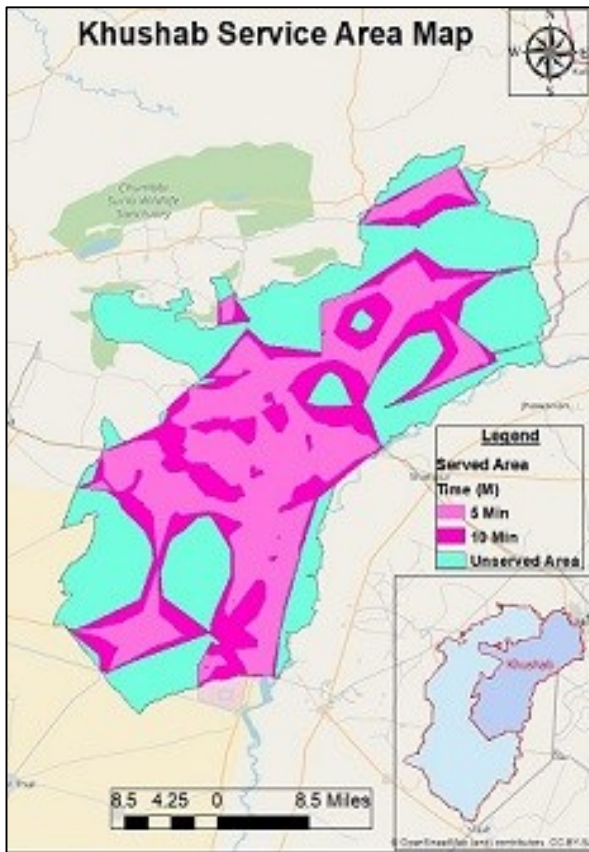
Fig. 7 Khushab suitable site map.

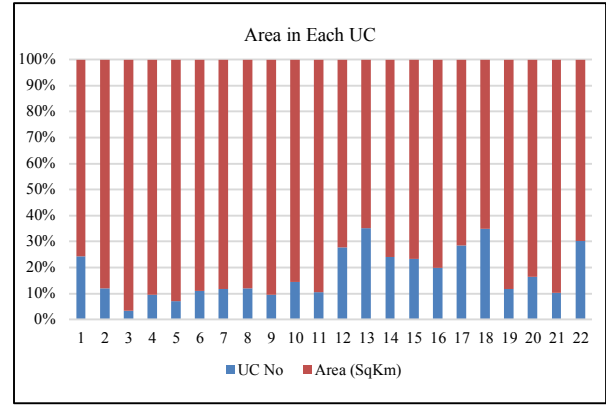Fig. 8 Khushab service area map

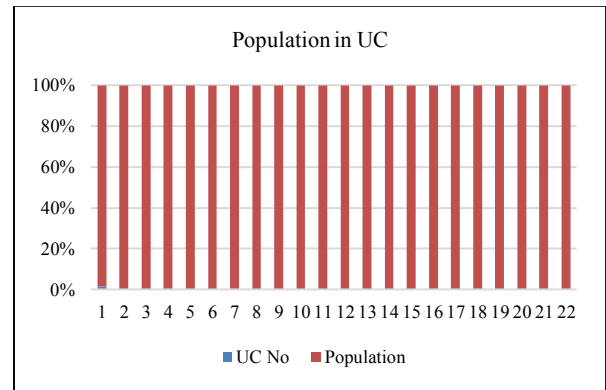Fig. 9 Total area in each union council
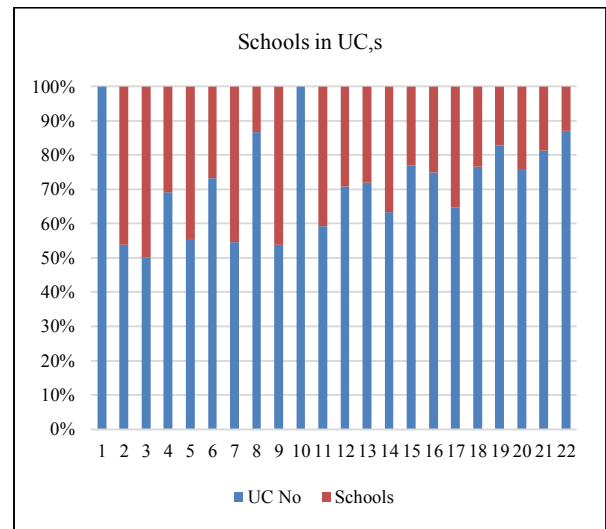

Fig. 10 Total population in each union council

Fig. 11 Total schools in union councils

land use data set represents the vacant spaces to establish new schools. Figure 5 shows the population density in each union council. Population plays a vital role while performing multicriteria analysis.

Figure 6 gives the DEM (Digital Elevation Model), used to find out the slope. The slope is key to examine the cost of travellers as well as pedestrians.

Figure 7 highlights the suitable sites for new schools to enhance the literacy rate in Khushab.

Conclusion

This study shows the application of GIS in accessing the existing school facility in the study area. Network service area analysis is more beneficial to observe the accessibility levels. More than 50% of the population is unserved that shows the improper spatial distribution of schools. Some areas like numbers 8, 21 and unioun council need the development of new facilities so that a large number of people could be facilitated.

References

Gregory, (2009). The dictionary of human geography Willey-Blackwell. (5).

Mladenka, K. R., Hill, K. Q. (1977). The distribution of benefits in an urban environment: Parks and libraries in Houston. *Urban Affairs Quarterly,* **13** (1), 73-94.

Oh, K., Jeong, S. (2007). Assessing the spatial distribution of urban parks using GIS. *Landscape and urban planning,* **82** (1-2), 25-32.

Omer, I. (2006). Evaluating accessibility using house-level data: A spatial equity perspective. *Computers, environment and urban systems,* **30** (3), 254-274.

Pooler, J. A. (1995). The use of spatial separation in the measurement of transportation accessibility. *Transportation Research Part A: Policy and Practice*, **29** (6), 421-427.

Tsou, K. W., Hung, Y. T., Chang, Y. L. (2005). An accessibility-based integrated measure of relative spatial equity in urban public facilities. *Cities*, **22** (6), 424-435.