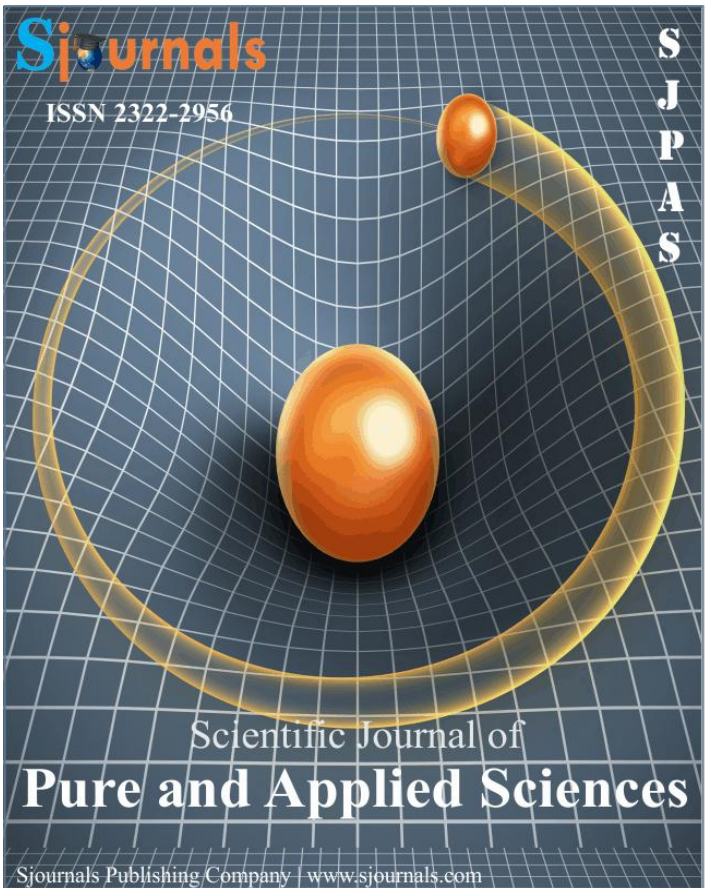

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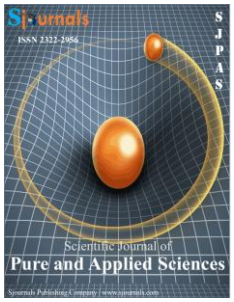

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Short communication

Applied Geographical Information System (GIS): Overlay analysis

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ABSTRACT

Technological limitations have posed challenges in integrating wildlife conservation needs with human land uses and other infrastructural development needs. The advent of the Global Position System (GPS) technology has made it possible to collect elephant location and human land use data. Geographic Information System (GIS) software has allowed overlay analysis of elephant location data and human land uses. This study, therefore demonstrates how the overlay analysis function in GIS can be employed to link human land use data layers and elephant location. To achieve this, the overlay analysis function was used to combine elephant location data with distance maps of each human land use factor. The distance values for each human land use factor were extracted at each elephant location using the map value function in ILWIS. The resultant table show extracted elephant location values and corresponding distances values for each human land use factor. Further research can be conducted by exporting elephant location values and corresponding land use values to SPSS to predict the human land uses which significantly influence the presence or absence of elephants. This study also recommends the use of the overlay analysis tool in Environmental Impact Assessment projects to model the most suitable site for a proposed project such as dam construction.

1. Introduction

Overlay functions forms the core computational activity of many GIS applications. In overlay functions, different data layers and new information is derived by creating features in a new layer. The principle of overlay is to combine features which occupy the same location. The overlay analysis function allows the combination of features from different layers to form a new map. The new map normally has new information and features which were not present in the individual maps. Thus, overlay analysis has emerged as an important tool in suitability modeling and land use planning. For instance, in siting a new residential area, overlay analysis is used to combine map of the proposed project with other maps such as flood hazard map, slope map and maps of existing services such as schools, clinics, and entertainment services. Siting a dumpsite also requires overlay analysis of different land use maps to come up with the most suitable place to site a dump. Such studies are critical in land use planning.

2. Methodology

2.1. Data collection

Human land use data was obtained through digitizing satellite remotely sensed imagery availed through Google earth. Elephant location data was acquired using a Global Position System (GPS) device.

2.2. Data analysis

2.2.1. Creation of distance surfaces in ILWIS GIS

The ILWIS GIS software was used to create distance surfaces for all the predictor variables (ITC, 2003). The distance surfaces which show the change of distance from the data layers such as settlements, mined out areas, water points, and agricultural fields were created from raster maps of land cover types using the distance calculation function in ILWIS GIS (Fig. 3.4, Fig. 3.5 and Fig. 3.6).

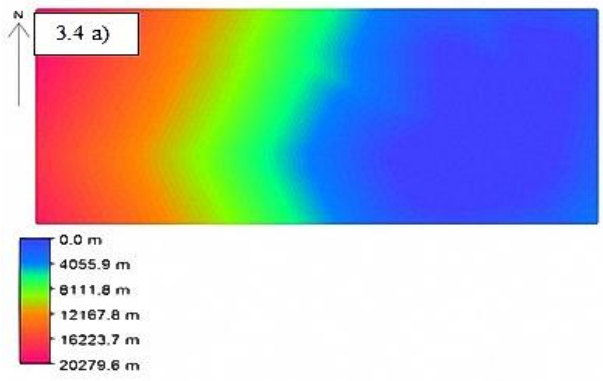

Fig. 3.4a. Crop fields distance map.

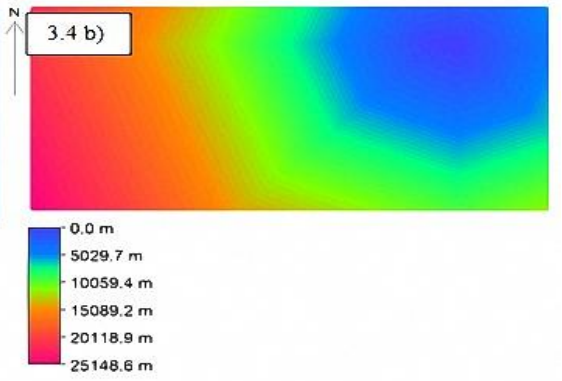

Fig. 3.4b. Dam distance map.

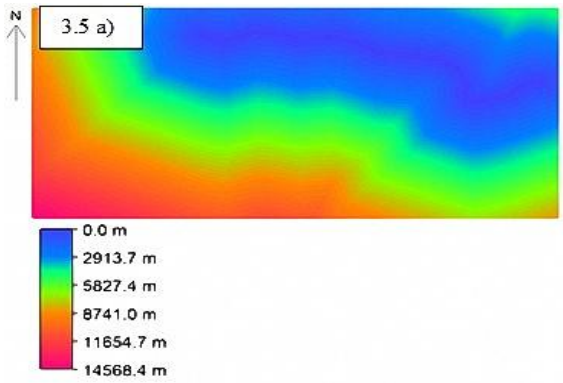

Fig. 3.5a. Main road distance map.

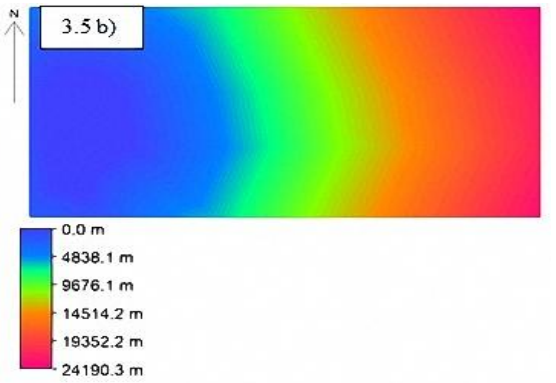

Fig. 3.5b. Main dumps distance map.

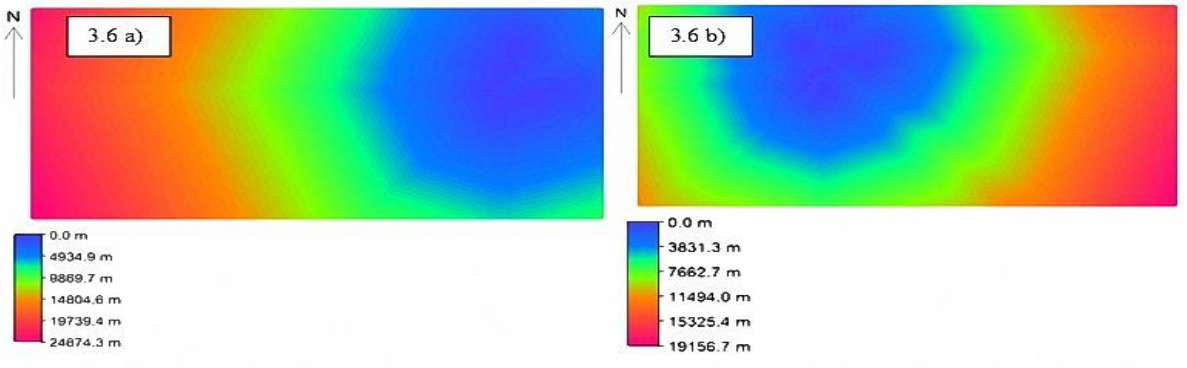

Fig. 3.6a. Rural settlement distance map.

Fig. 3.6b. Urban settlement distance map.

2.2.2. Overlay analysis using ILWIS GIS

The overlay analysis function was used to combine elephant location data with distance maps of each human land use factor. The distance values for each human land use factor were extracted at each elephant location using the map value function in ILWIS. The map value function used takes the following form: Distance of elephant location from human land use factor=Map value (human land factor distance map, coordinate(x, y)).

3. Results

Table 1

Elephant location values and corresponding distances values.

Table "allllllllllll hwange data2222" - ILWIS

File Edit Columns Records View Help

WATERVALUES=MAPVALUE(waterdistance,COORD(X,Y))

	x	y	elephalldata	SETTLEMENT	MINEDAREA	AGRIC	WATER
1	443437.0	7969053.0	0.0	7336	2648	4704	3682
2	443007.0	7968579.0	0.0	6755	2050	4310	3101
3	442620.0	7968472.0	0.0	6331	1783	3978	2677
4	442642.0	7968407.0	0.0	6337	1737	4008	2683
5	443201.0	7968300.0	0.0	6842	1841	4559	3258
6	442534.0	7968278.0	0.0	6174	1597	3891	2590
7	442448.0	7967784.0	0.0	5889	1104	3787	2701
8	443900.0	7967827.0	0.0	7336	1696	5192	4100
9	442470.0	7967805.0	0.0	5930	1133	3804	2718
10	442792.0	7967676.0	0.0	6203	1098	4170	3084
11	442577.0	7966213.0	0.0	5430	0	3613	3340
12	442125.0	7966192.0	0.0	4983	0	3165	2916
13	442319.0	7966235.0	0.0	5169	0	3351	3078
14	442233.0	7965891.0	0.0	4954	0	3136	3119
15	442039.0	7965203.0	0.0			2695	3212

Table 1 depicts the extracted elephant location values and corresponding distances values for each human land use factor. It shows how far human land uses are located from each elephant location.

It is recommended that further research be conducted by predicting the factors which influence the presence or absence of elephants using binary logistic regression in SPSS. Habitat suitability mapping can also be conducted to delineate elephant habitat from human land uses. Such an approach is key in integrating elephant conservation needs and development needs. This can also play a great role when it comes to human-elephant conflict problems which face most settlements located in proximity to elephant sanctuaries.

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