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INDENTIFICATION AND MAPPING OF ENCROACHMENT AT PLOT LEVEL FOR VRINDAWAN HOUSING SCHEME AT RAEBARELI ROAD, UTTAR PRADESH AWAS VIKAS PARISHAD, LUCKNOW, USING IKONOS SATELLITE DATA, GIS & GPS TECHNIQUES

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ABSTRACT In India, Cadastre represents a land parcel which reflects the entitlement of land holding , area of the land and landuse of that land parcel. In cities or in alignment of road on goverment/ privite land, encroachment/ unauthorized construction has become a common practice by people in our country. Therefore taking quantative information, like area and extent from these maps may sometimes give enormous information about the land holdings. Most importantly, acquiring the land and making a landuse plan for housing scheme requires the accurate information related to encroachment, keeping in view the objective of providing accurate information on encroachment at plot level, IKONOS satellite's 1m resolution data was used in present study. The study has been carried at one site of Raebareli road, Uttar Pradesh Housing Board, Lucknow. The study area covers 1823124.10 m, where housing scheme is proposed for housing. It has been found that there is a lot of encroachment at various plot, which has been acquired by U.P. Housing Board, Lucknow for development of resedential colony.

Key Words- IKONOS Satellite High Resolution Data, Cadastre, Enroachment, GIS And GPS Techniques.

I. INTRODUCTION

Uttar Pradesh is the most populous state in our country. Which is having 724 urban local bodies i.e. Nagar Panchayat / Nagarpalika Parishad / municipal corporations including cantonment board & industrial township and around 2.71 lakhs of habited and non-habitated villages as per Census of India, 2011, with 19.91 crore of total population. Various cities/ towns of the state have achieved the status of first class towns/ cities in the recent years and 7933 cities are reported in our country accordingly. (Kumar, V. 2012). Due to excessive pressure of population, rapid urbanization took place and as resultant, numbers of colonies has been developed by development authorities. These colonies have been taken up by urban local bodies as a resultant the urban density of the state is now reported around 4937 persons. Whereas the average density of the state is 473 person per sq. km, and there is an increased need of housing for urban population. In this context to fulfill the housing need for people, the increasing role and activities of development authorities is more complex to acquire the land for planning & development of residential colonies in urban areas. (Gopalan, A.K.S. 2009) has discussed that fine spatial resolution satellite data allows small objects to be seen and mapped, special choice of spectral bands enhances the discriminating ability between the land covers. In past two decades space borne technology based data have been successfully utilized for identification, mapping, monitoring, encroachment and other public utility/facilities information of any urban area in detail coupled with cadastral maps, Geographical Information System (GIS) and Global Positioning System (GPS). (Rao & Shekhar, 2000), has suggested that in India, cadastre is the basic unit to provide plot wise reliable information regarding land holding/land revenue system. But unfortunately these cadastre are often quite old (above thirty years old) and still maintained on paper or cloth. Geo-referencing and overlaying of these cadastres on high resolution data can provide the accurate information on encroachment/unauthorized construction at each and every land holding. Disputes among farmers taking into consideration of plot boundaries can also be solved using high resolution remote sensing data. The present paper is an endeavor to analyze the plot wise encroachment/built-up area at Vrindawan Housing Scheme, Raebareli Road, under Housing Development Board, Lucknow, Uttar Pradesh, India. The digital database generated for the study area would be very useful for urban planners/decision makers for proper land use planning and management.

II. STUDY AREA

Lucknow city is located in Central part of Uttar Pradesh the area lies between $26^0$55'11.12"N latitude and $80^0$59'55.55"E longitudes. State of Uttar Pradesh is the most populated state in India, Lucknow the capital city of U.P. is situated on the banks of river Gomati that divides the city into two equal halves the main urban area of city is in south-eastern part of Gomati river and trans-gomati area is an sub city of Lucknow metropolitan area. (Fig.1).The present study area covers 1823124.10 sq m approximately. Due to capital town of Uttar Pradesh, city is well connected with rail/road transportation system with all parts/ cities of India. The study area is situated in South Eastern part of Lucknow city near Sanjay Gandhi Post Graduate Institute of Medical Sciences (SGPGI) Lucknow.

III. OBJECTIVES

The objective of the present study is identification and mapping of encroachment/unauthorized construction for vrindawan housing site at Raebareli Road under Awas Vikas Parishad, Lucknow, Uttar Pradesh, India, using high resolution remote sensing data, cadastral maps, Geographical Information System (GIS) and Global Positioning System (GPS) Techniques**.**

A. Location Map of Study Area

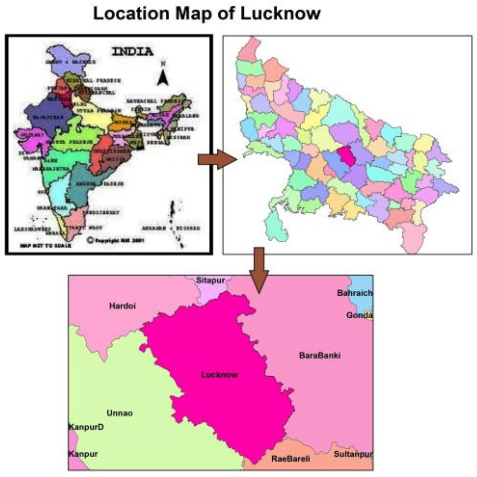

Figure: 1

IV. MATERIALS & DATA USED

- Guide map of Lucknow city on1:20,000 scale.
- Cadastral map of study area on 1:4,000 scales.
- IKONOS Satellite's (Google Earth) 1m resolution data acquired on 27 April, 2013.
- Ground Truth data.
- Survey of India topographical map sheet no. 63B/13 of Lucknow and its environs on 1:25000/1:50000 scales surveyed between 1966-67 and 1972.

V. SOFTWARE & EQUIPMENT

- Arc-GIS 10.1 v.
- G.P.S-Mobile Mapper Field & Office Software 10.0 v.

VI. METHODOLOGY

The procedure followed for identification and mapping of encroachment on 1:1,000 scales and for preparation of digital database using remote sensing and GIS techniques is discussed in brief as under:

The Raebareli Road Vrindawan Scheme area acquired by U.P. Awas Vikas Parishad Lucknow has been mapped in this project using remote sensing & Geographical Information System (GIS) and Global Positioning System-Mobile Mapper Field & Office Software (GPS). This project work was carried out to prepare detailed information for mapping and monitoring the encroachment at plot level of the study area. Cadastral map of the area collected from sponsoring department, it was scanned (**Fig.2)** and geo-referenced in conjunction with IKONOS satellite data in GIS environment. After geo-referencing of cadastral map, all available/collected maps were corrected and geo-referenced to real earth coordinates and same projection of Universal Transverse Mercator (UTM) and World Geodetic System 84 (WGS_84) was given to each and every map. Cadastral map were also vectorized and digitized and attributes coding of each and every plots i.e. plot no. (khasra number) has been assigned. The road/transport-network map-city major/minor roads/streets, railway line, water bodies, drainage/nala etc. were interpreted as a linear/ polygon feature using Arc-GIS software and IKONOS satellite's 1m resolution data. After preparation of base map, the cadastral map was overlaid on 1m resolution satellite data. Encroachment/unauthorized construction existing in plots of study area have been identified and demarcated after superimposition of cadastral map on high resolution data in GIS domain. The cadastral maps overlaid on geo-referenced data have also been further checked/verified on the ground for conducting field survey for collection of field information related to encroachment. A detailed ground truth verification/field survey has been carried out with the help of Global Positioning System- Mobile Mapper Field & Office Software (GPS) to know the exact location of unauthorized construction/land use with their actual extent. The individual polygons of encroachment/built-up area have been given attributes coding in GIS environment. After field survey of the study area through GPS, the data collected in field, were converted into tabular format and they have been matched and linked with digitized maps in GIS domain for preparation of final map on 1:4,000/1:2,000 scales.

VII. RESULT AND DISCUSSIONS

To create the digital database for Vrindawan Housing Scheme, Raebareli Road, Lucknow, Uttar Pradesh, India, at first base map including road/transport-network, city major/minor roads, railways line, canal/distribution, river, drainage/nala, on 1:1,000 scale was prepared at cadastral level for generating the information of each and every plot, and the area under road/transport-network category occupies 124140.788 sq m. and the area of encroachment/unauthorized construction has been calculated in GIS domain, which occupy 194499.505 sq m out of total study area, which is 10.668% of toal study area. The results on encroachment/unauthorised construction are summarised in Table-1. cadastral map, small encroached units has been identified and mapped at 119 plots out of total numbers of 591 plots/land holdings (**Fig-3**), In study area where more than one plot is encroached/ construction is found adjacently in plots, their plot no. are shown at one serial no. in Table No.1. The numbers of encroached/built up/ unauthorized construction plots area has been shown in **Table-1** indicating the land holding numbers (khasra number). **Fig-4** shows the all small land parcel overlaid on satellite data, which has been encroached by the people in study area. Whereas per square feet land cost for residential/commercial/industrial/institutional and for other purposes/ uses is very high due to capital town.

VIII. RECOMMENDATIONS

- Before acquisition of land for residential colony purpose by development authorities, prime agricultural land should be avoided and the culture of vertical city development is needed to fulfill the need of increased housing in urban periphery.

- Investigation of soil's building load bearing capacity should be compulsory for all govt. /private construction companies to avoid the manmade disaster like land subsidence.
- Laws / standards of eco-city planning should be compulsory for all govt. /private builders.

IX. CONCLUSION

The remotely sensed data, Geographical Information System (GIS) and Global Positioning System (GPS) has proved an effective tool in plot level rural/urban/cadastral mapping, monitoring and analysis. The spatial extent of various small construction units/encroachment identified and interpreted at plot level for the study area will be useful for planners and decision makers at micro level planning & management. Furthermore, the development of intelligent GIS with high resolution panchromatic & multispectral data of Quickbird, IKONOS, Worldview, Worldviw-3, Cartosat-1, Cartosat-2 & Geoeye, KOMPSAT may enable generating parcel level land use/ land cover inventories necessary for future/ sustainable development of land resource and may facilitate monitoring the input of implementation of suggested land use program in urban / rural area.

Scanned Map of Vrindawan Awas Vikas Scheme, Lucknow

Figure: 2

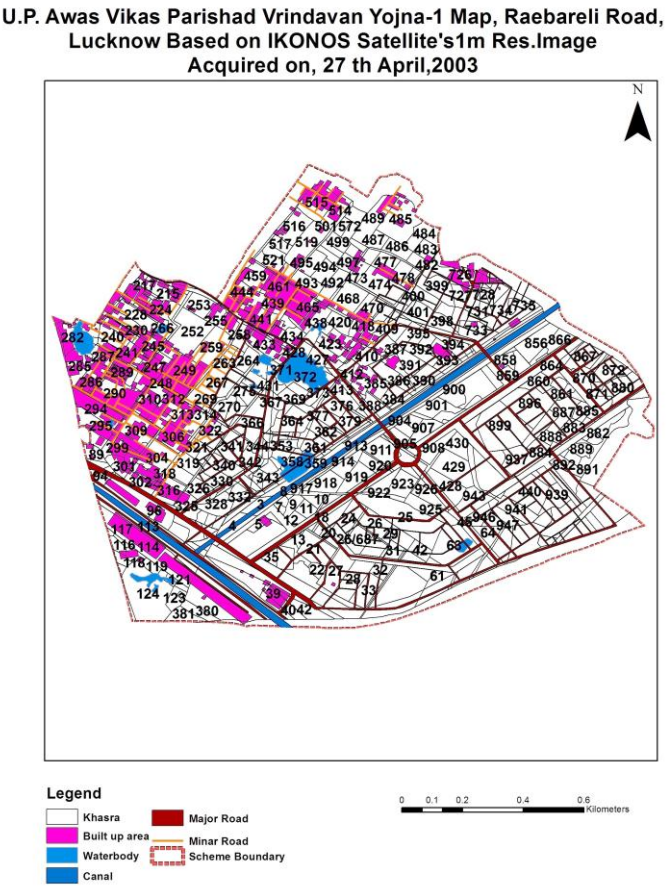

Figure: 3

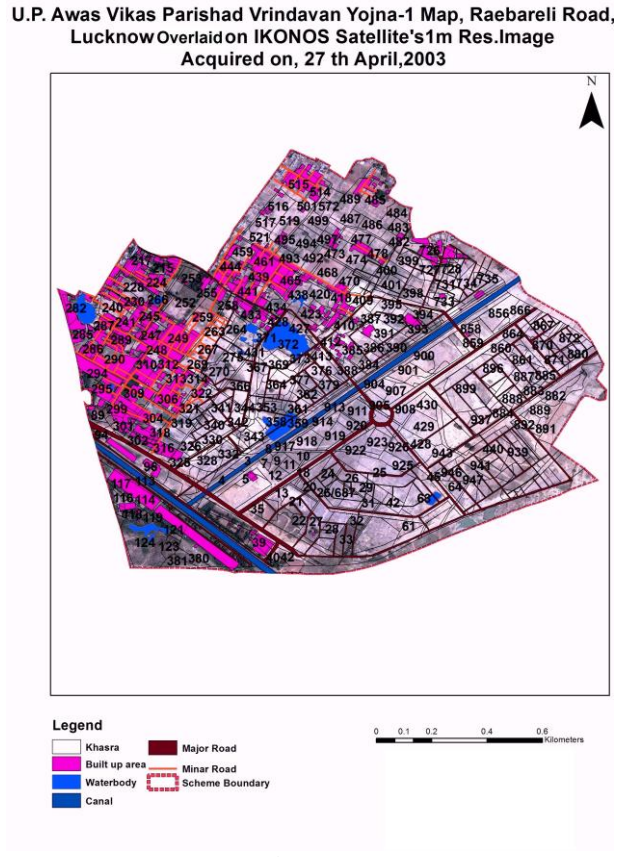

Figure: 4

Table-1: Plotwise Encroachment/Built-Up Area At Housing Site Of Raebareli Road Vrindawan Scheme, Awas Vikas Parishad Lucknow, Uttar Pradesh

S.No	Plot No	Area sqm
1	5	765.486
2	21	505.403
3	27	85.824
4	39/40/42	3763.92
5	89	190.926
6	114	19115.059
7	118/126	1510.348
8	213	1351.184
9	214/215	859.718
10	217	871.937
11	218	1736.725
12	221/222/224	4972.222
13	228	841.056
14	230	414.257
15	235/237	2339.237
16	238/239	4226.811
17	240	16.696
18	241	685.245
19	243	971.722
20	245	1937.804
21	247/249	8996.178
22	248	2850.307
23	252	132.483
24	253	253.529
25	257	702.131
26	258	778.959
27	259	489.034
28	272	600.437
29	281	423.582
30	282/285	6403.971
31	286/287	5297.49
32	289	2432.767
33	290/292	9509.021
34	294	7360.302
35	295	3344.315
36	299	3197.763
37	301	1144.571
38	302	1618.071
39	303/304	2690.685
40	306/313/314	7458.201
41	308/309	4953.138
42	310/311/312	7534.819
43	316/325	3246.693
44	322	916.958
45	385	1053.391
46	387	1179.351
47	395	1704.228
48	408	374.77
49	409	1015.381
50	410	27.581
51	411	266.084
52	412	253.376
53	413	35.231
54	414	269.986
55	417	1886.272
56	418	1521.288
57	422	1057.319
58	423	438.072
59	425	542.106
60	433	3271.567
61	434	878.648
62	435	875.871
63	437	41.329
64	438/466	1083.4
65	439	779.229
66	441	3480.149
67	442	1188.014
68	443	111.552
69	444	2046.217
70	445	1334.218
71	459	1419.397
72	460/461/462	7970.706
73	463/465	4224.594
74	468	1225.148
75	470	779.99
76	473	241.514
77	474	1325.771
78	475	75.167
79	477	831.934
80	483	433.606
81	485/489	2563.208
82	491	568.149
83	492	37.141
84	493	898.948
85	497	492.929
86	514	1418.955
87	515	6434.044
88	516	854.865
89	519	1068.444
90	520	103.737
91	521	56.222
92	726	4318.663
93	733	233.43
94	734	584.993
95	858	126.335
	Total	194499.505

X. ACKNOWLEDGEMENT

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