3. Material and Methods

Information on wastelands was derived from multi-temporal data either by digital analysis or visual interpretation. Visual interpretation was carried out displaying the digital data on the color monitor and wasteland categories were delineated through on screen interpretation. Software's ARC/MAP. 9.2, ERDAS IMAGINE 9.3, Microsoft Office 2007 were used for this study UNIP/ISRIC (1991). Digital data was loaded and geo-referenced with the help of ground control points by using image processing software. Details of methodology of wastelands change analysis is described in the flow chart (fig. 2). The methodology involved on-screen interpretation of multi season IRS-IC/ID LISS-III digital data from NRSC (National Remote Sensing Centre) of Rabi, Kharif & Zaid crops for the year 2008-09 for interpretation of various wastelands categories. Ground truth data collected from various places was used to finalize the map.

The Vector data of wastelands generated during 2005-06 was used to generate change detection, methodology flow chart is shown in fig-2. Survey of India topographical maps were used for identifying villages' locations, major transport network, cultural features and annotation of major towns and cities (Manual, NRSA 2010)..

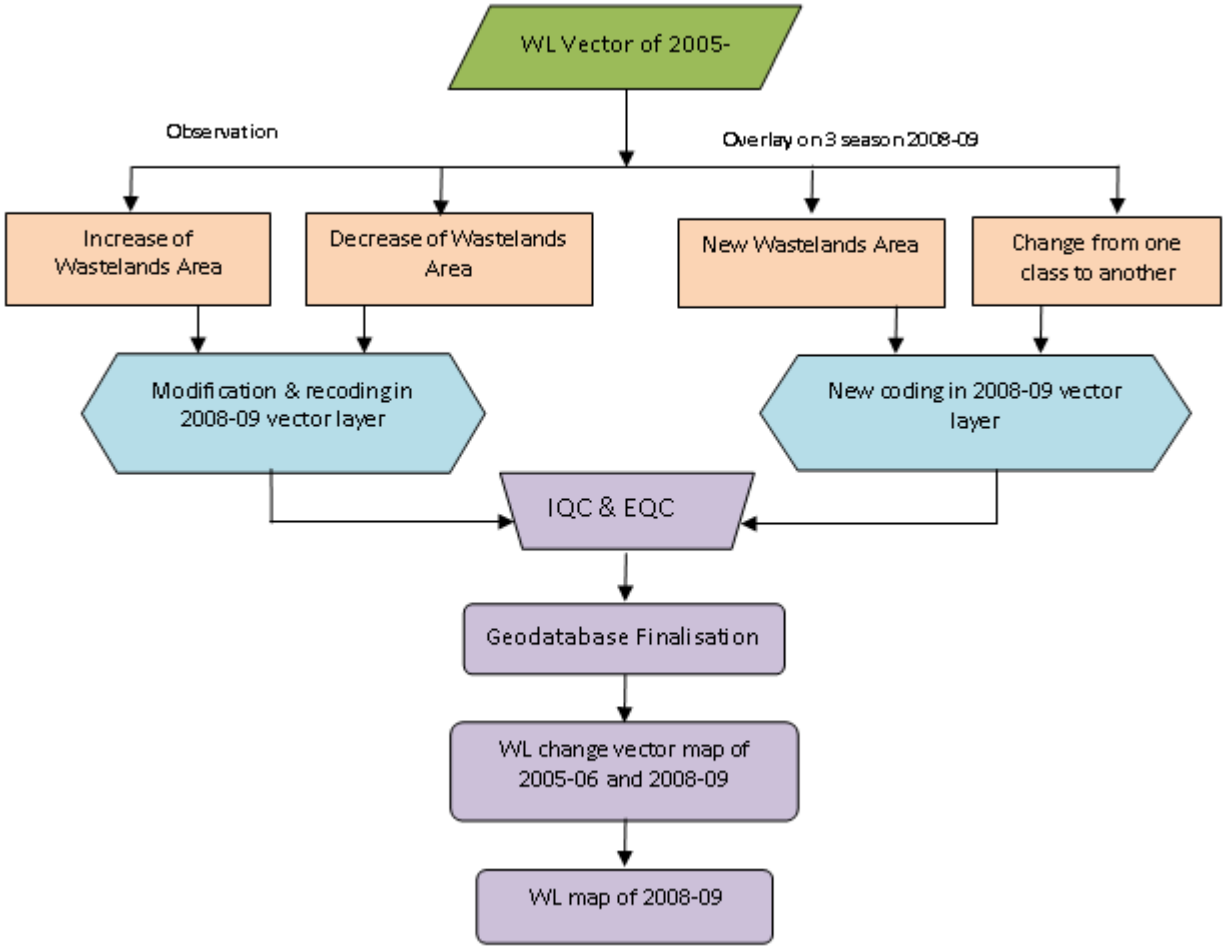

Figure 2: Methodology flow chart

4. Results and Discussion

Description of Wastelands

Wasteland mapping of the Hisar district was completed with multi season satellite data for the year 2008-09. The total area under various wasteland categories is 130.68 sq. km. which contributes 10.42 % of the total geographical area of the district. The area of these wastelands is given in Table-1; the graphical and pictorial representations are shown in Fig-3. The brief description of these wasteland categories is as follows:

Scrub Land:

These areas possess shallow and skeletal soils, at times chemically degraded. It is scattered in all over the district where water availability is very less. They possess sparse vegetation or devoid of scrub and have a thin soil covers. It is found scattered in northern part of the district where water availability is very less. The prominent patch is observed

around Bandhwari village in the east and Manesar village in the central part of the district. The total area under open class is 99.06 sq.km. Which covers 7.90 % of total geographical area which was 106.03 sq. km. during 2005-06. Area under this category is increased by 6.97 sq.km. The total area under dense class is 2.36 sq.km. Which covers 0.19 % of total geographical area

Waterlogged and Marshy land (Permanent/Seasonal)
Mostly the waterlogged area in the district is either in the local depressions or along the canals. During rainy season, the water accumulates in the depressions and creates water logging. Water logging is also caused due to canal seepage along the banks. Seasonal and Permanent waterlogged areas were identified in the district. The areas which were waterlogged only in kharif season were classified as seasonal waterlogged areas whereas, if water logging was observed in all the three seasons, those areas were put under permanent waterlogged areas. The area under permanent waterlogged category was 0.23 sq.km. i.e. 0.02 % during 2005-06 of the total geographical area of the district and no change is observed in 2008-09. The area under seasonal waterlogged was 0.10 sq.km. i.e. 0.01% during 2005-06 and is decreased by 0.01 sq.km in 2008-09. These categories lie in the north of the district.

Salt Affected Land (Moderate and strong)
Salt affected land is generally characterized as the land that has adverse effects on the growth of most plants due to the action or presence of excess soluble salts (saline) or high exchangeable sodium. The salt affected land is found either near the canals due to canal seepage or in the low lying areas where water table has come up. The area under moderately salt affected class was 0.34 sq. Km. which covers 0.03 % of the total geographical area during 2005-06. Area under this category is decreased by 0.12 sq.km in 2008-09. The area under strongly salt affected class was 0.04 sq. Km. during 2005-06, which is 0.06 sq. km. in 2008-09.

Degraded Pasture/ Grazing Land
These are spread mainly on village panchayat lands associated with village surroundings. The pasture and grazing land with natural plantation have become degraded due to neglected land management (lack of proper soil conservation and drainage measures). These overgrazed lands are covered by bushes, scrubs or with scattered trees. Prominent patches are observed near Farrukhnagar village in the west, Jatauli and Khor villages in the south-west, Tikli and Garhi Bazidpur villages in the south-east, and Gurgaon City in the north. Area under this category was 21.56 sq.km. i.e. 1.72% of total geographical area of the district in 2005-06. Area under this category is decreased by 1.92 sq.km in 2008-09.

Degraded Land under Plantation Crops:
These are the lands under plantation crop but devoid of tree cover and mainly filled with bushes and shrubs. The canopy cover is less than 20 per cent. Some patches are observed between Farrukhnagar and Karaula villages in the western part and in some part of the south of the district.The area under this category during 2005-06 was 6.08 sq.km. which covers 0.48 % of total geographical area in the district. Area under this category is decreased by 4.01 sq.km in 2008-09.

Mining Wastelands
Mine dumps also includes the area of brick kiln in which surface sand of that area is lifted app. 2 to 3 feet for making of bricks. This land can be brought under cultivation after regular inputs in few years. Some patches are observed in the northeast and western part of the district. The area under this category during 2005-06 was 0.43 sq.km. which covers 0.03% of the total geographic area of the district. Area under this category is decreased by 0.03 sq.km in 2008-09.

Industrial Wasteland
These are areas of stockpile of storage dump of industrial raw material or slag/effluents or waste material or quarried/mixed debris from earth's surface. The area under this category during 2005-06 was 0.01 sq.km. and no change is observed.

5. Conclusion

The data reveals that the total wastelands area in 2008-09 of the district is about 130.68 sq.km, which accounts for 10.42% of the total geographical area, which was 11.31% during 2005-06. Total wasteland area decreased by 11.12 sq.km. which is 0.89 % of the total geographical area. The increasing population pressure, urbanization and industrialization have put a great stress on natural resources resulting in the decrease in agricultural area. So, there is an urgent need to identify and reclaim these degraded lands in the state. The major category of the district is land with open scrub consisting of 99.06 sq.km. i.e. 7.90 % of total geographical area of the district.

Table 1: Wastelands under different Categories and change detection

SI	*Wasteland Categories*	*2008-09*	*%*	*2005-06*	*%*	*Change*	*% diff.*
1	Land with Dense scrub	2.36	0.19	0.00	0.00	2.36	0.19
2	Land with Open scrub	99.06	7.90	106.03	8.46	-6.97	-0.56
3	Water logged & Marshy land permanent	0.23	0.02	0.23	0.02	0.00	0.00
4	Water logged & Marshy land seasonal	0.09	0.01	0.10	0.01	-0.01	0.00
5	Land affected with salinity/alkalinity-Moderate	0.22	0.02	0.34	0.03	-0.12	-0.01
6	Land affected with salinity/alkalinity-Strong	0.06	0.00	0.04	0.00	0.02	0.00
7	Under-utilized/degraded forest (scrub dominated)	6.54	0.52	6.98	0.56	-0.44	-0.04
8	Degraded pasture/grazing land	19.64	1.57	21.56	1.72	-1.92	-0.15
9	Degraded land under plantation crops	2.07	0.17	6.08	0.48	-4.01	-0.31
10	Mining Wastelands	0.40	0.03	0.43	0.03	-0.03	0.00
11	Industrial Wastelands	0.01	0.00	0.01	0.00	0.00	0.00
	Total	**130.68**	**10.42**	**141.80**	**11.31**	**-11.12**	**-0.89**

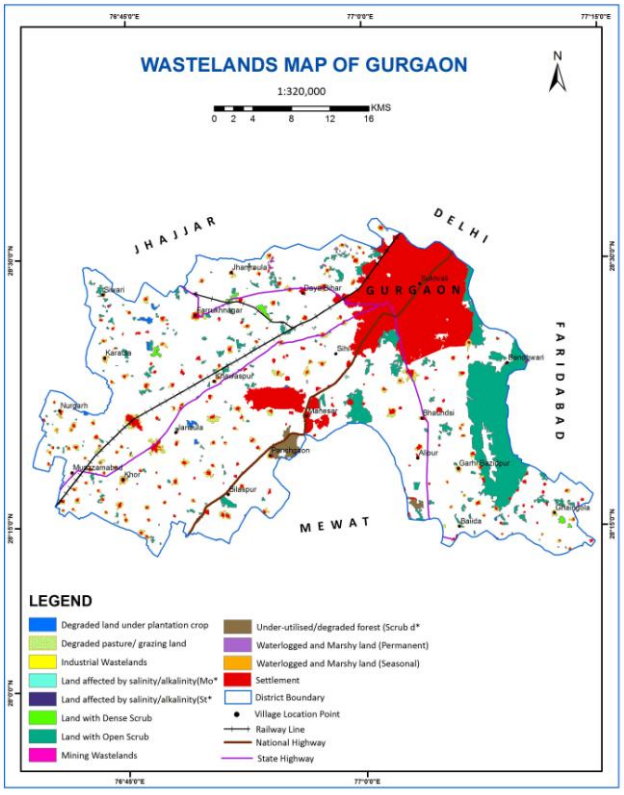

Figure 3: Wasteland Map under different Categories of Gurgaon.

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