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tehsils include Walwa, Palus and Miraj tehsils from Sangli district (30.00%) were in the zone high literacy .Two tehsils included Pune city, Havali in the Pune district (14.00%) were in the high literacy zone. One tehsil included Karveer in Kolhapur district (17.00 %) were in the Zone of high literacy, Most of the tehsils like Pune, Haveli, Karad, Sarara, Karveer, and Miraj were relatively highly urbanized tehsils in Western Maharashtra. These highly urbanized tehsils produced employment opportunities' to mostly literate and educated people from the non-agricultural sector. Therefore, literate population migrated towards these population migrated towards these tehsils from surrounding areas caused high proportion of literacy.Industrilisation was also important factor for the high literacy in the tehsils like Karad, Satara, Pune, Havali, Koregaon, Miraj, Karveer. Appart from that co-operative sector supported the education facilities in many of the tehsils, which comprised the zone of high literacy, such as Karad, Satara tehsil ,Walwa,Palus Karveer, Havali co-operative sector is the main force behind the establishment of many educational institutes in these tehsils,Wai and Mahabaleshwar tehsils have tourist importance, secondary and tertiary activities were done by most of people and these circumstances manipulated the level of literacy in these tehsils. Many of the tehsils have uneven and rugged topography, but these tehsils are still fallen in the high literacy zone. These tehsils are sparsely populated and have scattered settlements, however, provided good setting and facilities of education. (Fig No-2 Table No 1)

Table No 1: **Tehsil wise Literacy rate in Western Maharashtra 2011**

Sr No.	Tehsils	literate Population	Population % Literacy
1	Karmala	168737	66.30
2	Madha	219312	67.68
3	Barshi	260269	69.83
4	North Solapur	766819	72.52
5	Mohol	182851	66.03
6	Pandharpur	299467	67.70
7	Malshiras	3242277	66.77
8	Sagola	203906	63.16
9	Mangalwedha	129075	62.68
10	South Solapur	165980	63.62
11	Akkalkot	189983	60.39
	Solapur	2910676	67.41
12	Mahabaleshwar	54970	75.48
13	Wai	152696	76.25
14	Khandala	104547	76.08
15	Phaltan	247826	72.32
16	Man	144459	64.02
17	Khatav	198498	72.11
18	Koregaon	196981	76.50
19	Satara	400106	79.69
20	Jaoli	78107	73.34
21	Patan	206298	68.88
22	Karad	441206	75.54
	Satara	2225694	74.10
23	Shirala	115112	70.66

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Factors Influencing Cropping Pattern

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Abstract:

Cropping pattern is most important and current topic for research in nowadays. To study the concept of cropping pattern and understand the factors influencing them is an essential thing. The present study is undertaken for the same purpose. Cropping pattern is arrangement of crops on farm or in a region with consideration of natural features and agricultural policy of nation. There are some major factors likephysical and technical factors, price and income maximization, farm size, insurance against risk, availability of farm inputs, land tenure, government policies and measures and plan target which influences cropping patterns directly and indirectly. In particular area, particular factors influences cropping pattern.

Objectives:

1) To study the concepts of cropping pattern
2) To study the factors influencing cropping pattern

Keywords: Cropping pattern, influencing factors

Introduction:

Cropping pattern relates to the ratio of area under different crops at a point of time. Quite often the area statistics are used to denote the cropping. Agricultural Commission Government of India (1960) determined cropping pattern according to relative acreage of various crops in a district or group of districts. According to Kanwar, cropping pattern means both the time and sequence of crops. It includes the identification of the most competent crops of the region which is considered a consistent soil and climate belt, the alternation in which the crop fits and the intensity of cropping.

According to Harwood, Cropping pattern is a longitudinal and temporal arrangement of cropsto be raised in a parcel of land. For Zandrastra, the term cropping pattern is used to denote the spatial and temporal contribution of crops on a plot management used to produce them.According to Mahendra Pal, Cropping pattern refers to the relative arrangements of crops on a farm, region, province or country with due consideration to natural features like, soil and climate, crop production, land capability, infrastructure which is changeable and the nation's agricultural policy.

A change in cropping pattern would mean a change in theequivalent area under different crops. If the proportion of area under a high value crop increases, it is likely to result in increase in the total return even if there is no increase in the harvest rate or price provided, there is concurrent decrease in the proportionate area under other equally or more valuable crops. A shift in the cropping pattern could be either advantageous or disadvantageous according to the nature of the shift. Principally food grains oriented cropping pattern like that of Karnataka, a substantial increase in the proportion of area under the crops other than food grains might be taken as a

radical change and for the reason that commercial crops generally command a larger return percent of cultivated area, such a change may also turn out to be beneficial from the point of view of the farmers.

Factors Influencing Cropping Pattern

Various factors influence cropping pattern in agriculture. Major factors influencing cropping pattern relate to both economic and noneconomic considerations viz.

1) Physical and Technical Factors
2) Price and Income Maximization
3) Farm Size
4) Insurance against Risk
5) Availability of Farm Inputs
6) Land Tenure
7) Government Policies and Measures
8) Plan Target

Physical and Technical Factors

Physical characteristics of any region have a deep influence on the cropping pattern in agriculture. Physical characteristics include soil and climatic conditions which have direct influence on the cropping pattern. Specific soils are suitable for growing certain type of crops. Crops have to be selected taking into account the type of soil which the nature has gifted to different areas and regions. Soil conditions cannot be reformed but can only be enhanced. Hence, the crops have to be chosen based on the natural endowment of soil. Weather and climatic conditions also influence the cropping patterns which again are determined by nature. Agricultural operations have to be adjusted to the regions climatic conditions. Hence weather and climatic conditions exert a static influence on cropping pattern in particular regions. Rainfall is another physical factor which has a influence on the cropping pattern in particular regions.

Certain crops need good quantity of water, while others need lesser amount of water. This factor becomes more relevant in rainfed agricultural areas where irrigation facilities are not available. Thus depending upon the rainfall farmers have to decide their cropping pattern accordingly. In dry area for instance where rainfall is scanty and high uncertainty of monsoon there will be greater dependence on crops like Jowar and Bajra as these crops need lesser amount of rainfall. High rainfall in malnad and coastal areas is found useful for growing paddy. Similarly good irrigation facilities in parts of Karnataka have helped farmers to grow sugarcane. Irrigation facilities help in getting more than one crop and superior crops can be grown. Horticulture crops are suitable in places with good rainfall and irrigation.

It is also observed that cropping pattern may change with adequate capital for better implements, improved seeds and finance for getting fertilizers. These facilities enable farmers to go in for better technology in farm management and a rapid change in the cropping pattern for better income and profitable agriculture.

Price and Income Maximization

Price movements of agricultural products influence croppingpattern. Farmers are clearly interested in better price for their products and the market price of agricultural product very much influence them in changing their cropping pattern and to get thebest price for their output. A study of inter crop price parities undertaken by the Ministry of Food and Agriculture has

pointed out the relationship between process and the cropping pattern. It seems that prices influence the acreage under the crops in two ways; one is that difference in the inter-crop price parities led to shifts in acreage between the crops. Another is that the maintenance of a stable level of prices for a crop provides to increase the output than what a very high level of price does, if there is no uncertainty of this level being maintained over number of years. Fixed obtaining price of wheat and rice and other government control have encouraged farmer to shift to cash crops like sugarcane.

Crop pattern is very much influenced by income considerations of the farmers. This is an important economic consideration influencing the cropping pattern. This aspect has been largely accepted by economic analysts in the area of farm economics. Farmers choose that combination of crops which would give them maximum income. It is argued that comparative profitability per acre is the main consideration, which influences the crop pattern. Thus farmers are influenced in the choice of crop by such consideration of price parities different products or maximization of income or relative profitability per acre.

Farm Size

Small farms govern the agricultural economy of most of thedeveloping countries. In developing countries like India small farmers are largely poor and depend upon these farms for their sustenance on these farms. Hence they go in for food crops on these small farms in preference to commercial crops since food grains forms the major expenditure items in their lives and account for the major part of their income. Hence small farmers have little option for commercial crops and prefer to grow cereals and other food grains on their farms. Medium and large farmers diversify their cropping and devote a good part of their farms for different crops to enhance their farm income through diversification of their agriculture. Hence size of the farms is an important factor determining the cropping pattern.

Insurance against Risk

Cropping pattern is also influenced by the risks involved incertain crops and the need for insuring against the risks. Crop insurances become necessary in dry areas. Hence crops have to be planned taking into account the risk of crop failures and the need for insuring.

Availability of Inputs

Availability of farm inputs also influences the cropping pattern.The inputs such as seeds, fertilizers, water storage, marketing, transport and irrigation, etc. are needed for growing certain crops. Inthe absence of availability of proper seeds certain crops cannot be grown in some areas even though the soil conditions are favourable. Fertilizer is needed in case of high yield variety of crops. Its accessibilityis an important factor in growing such crops in certain areas. Water storage provides a source of irrigation and crops needing irrigation could be chosen on the availability of this vital input. Stuffcommodities like cotton, groundnut and cereals need proper marketing facilities. Hence marketing infrastructure is an important factor for growing such crops. Transport and irrigation influence mass production and distribution of farm products. These factors do exert their influence in determining the cropping pattern in certain areas. NCAER estimated, If additional irrigation facilities were provided in Punjab the cropping pattern on as much as 3.4 million acres could be changed of which nearly 1.6 million acres now under grain could be plot to more paying crops.

Tenure and Land Holdings

Land tenancy system like self- cultivation, crop sharing, leasing oflands, etc. influences the cropping pattern. Self -cultivation helps the owner farmers to decide their own cropping pattern. Crop sharing system puts a restraint on the tillers as the owner has more say in the matter of choice of crops. When the land is rented out to tenants the tenant has the freedom to choose the crop to be grown on the land and his decision has a bearing on the cropping pattern.

Government Measures and Crop Pattern

Cropping pattern is influenced by legislative and administrative measures of the Government apart from economic factors. Government measures include provision of infrastructure facilities like irrigation, electricity, transport and marketing organizations, etc. Government is also actively involved in providing vital inputs like high yielding varieties of seeds, fertilizers, etc. Government ensures adequate supplies of these inputs but also extends subsidies in the sale of these inputs. Adequate availability of these inputs provided by Government with subsidy measures has a direct bearing on the crop pattern in different regions.

Legislative measures of the Government too have their impact on cropping pattern. Government has enacted Food Crop Act, Land Use Act, Land Ceiling Acts, etc. Further the Government has also accepted measures like concentrated scheme for paddy, cotton and oilseeds, etc. All these carry supply into focus the possibility that while each individual measure may push the crop pattern in the direction intended in that measure. The overall effect of all these measures taken together in the entire crop pattern may not be in accordance with national requirements. The Grow More Food in India and other similar campaigns have this focus. Crop choice also takes into account the threats of repeateddraught and pest infestations for some crops. These stop farmers from opting for a more remunerative set of crops. These along with insufficient financial resources also result in changing decisions about cropping pattern.

Plan Target and Cropping Pattern

Government follows a policy of fixing targets of achieving agricultural growth and crop wise targets are fixed. These targets are based on the need to meet the growing need of food grains for the fast growing population and also the other raw materials needed from agriculture to industries like cotton textiles, etc. The targets for agricultural exports also influence the government policies for growing more agricultural and horticultural products. These policies are backed up by necessary support like credit, farm inputs, subsidy, etc. These policies of the Government fixing targets for agricultural crops do influence the cropping pattern in different areas. The government tries to influence the cropping pattern by tax measures, subsidies, etc.

Government also uses the policies of manipulation of prices for agricultural product which in turn will have its influence on cropping pattern by farmers. Cropping pattern expresses the shares of different crops in the farmers' total cultivated area in an agricultural year. It is an important indicator of farmers' decision-making ability, which witness dynamism over space and time in response to the changes in factors which determine the cropping pattern.

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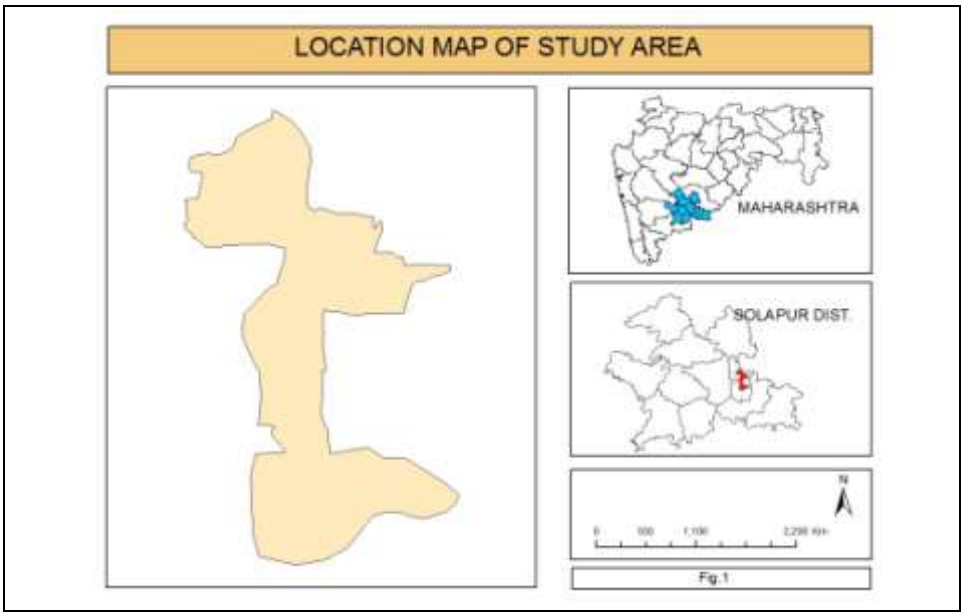
- To create a wetland cover classification scheme
- To determine the trend, nature, rate, location and magnitude of wetland cover change.
- To generate data on land consumption rate and land absorption coefficient since more emphasis is placed on built-up land.



Methodology

Data Acquired and Source

For the study, Landsat satellite images of north solapur were acquired for three Epochs; 1992, 2000 and 2014. Both 1992 to 2014 were obtained from Global Land Cover Facility (GLCF) an Earth Science Data Interface, earth explore.

It is also important to state that environs which were carved out using the local government boundary map and Nigerian Administrative map was also obtained from NASRDA. These were brought to Universal Transverse Mercator projection in zone 43 north Nepal and India.

Development of a Classification Scheme

Based on the priori knowledge of the study area for over 20 years and a brief reconnaissance survey with additional information from previous research in the study area, a classification scheme was developed for the study area after Anderson et al (1967). The classification scheme developed gives a rather broad classification where the wetland cover was identified by a single digit.

Code	Wetland Cover Categories
1	Built-up land
2	Water bodies
3	Vegetation
4	Wasteland

Data Used:

Data is soul of any information system. Any kind of analysis or results mainly depends upon reliability and accuracy of data. The efficiency and performance of any information system highly depends on nature, quality and availability of data.

Sr. No.	Data Used	Spatial Resolution	Data Source
01.	Landsat TM, Dec./ 1992	30m	www.glcf.com
02.	Landsat ETM,Dec./ 2000	30m	www.glcf.com
03	Landsat 8 April 2014	30m	www.earthexpoler.usgs.gov

The first three methods above were used for identifying change in the land use types. Therefore, they have been combined in this study.

The comparison of the wetland cover statistics assisted in identifying the percentage change, trend and rate of change between 1992 and 2014 In achieving this, the first task was to develop a table showing the area in hectares and the percentage change for each year (1992, 2000 and 2014) measured against each.

Database Design and Organization:

The database for the integrated development has basically two components, i.e. Spatial and Non-spatial data. The Geographical Information System (GIS) package is the heart of the data for handling the two sets of data. In the present study a standard GIS package has been employed as the main tool to design, organization, storage, retrieval, analysis, and generation of cartographic outputs. As two type's data sets to be organized in GIS environment, it was felt necessary to evolve a set of designed parameter that would have to be adopted for the database organization. The database design not only helps for a systematic database organization but also provides a level of flexibility to enhancement/ upgradation/ improvement. The methodology is divided into following modules.

Geodatabase Generation:

The geodatabase is the common data storage and management framework for Arc GIS. It combines "geo" (spatial data) with "database" (data repository) to create a central data repository for spatial data storage and management. It is the primary mechanism used to organize and use geographic information in Arc GIS. The geodatabase contains three primary dataset types:

- Feature classes
- Raster datasets
- Tables

Creating a collection of these dataset types is the first step in designing and building a geodatabase.

Geodatabase storage includes the schema and rule base for each geographic dataset plus simple, tabular storage of the spatial and attribute data. All three primary datasets in the geodatabase (feature classes, attribute tables, and raster datasets) as well as other geodatabase elements are stored using tables. The spatial representations in geographic datasets are stored as either vector features or as rasters. These geometries are stored and managed in attribute columns along with traditional tabular attribute fields.

A feature class is stored as a table. Each row represents one feature. Feature classes are homogeneous collections of common features, each having the same spatial representation, such as points, lines, or polygons, and a common set of attribute columns, for example, a line feature class for representing road centerlines. The four most commonly used feature classes in the geodatabase are points, lines, polygons, and annotation (the geodatabase name for map text).

The Geodatabase is created for storing, processing and retrieval of spatial data. The Feature Dataset is created with WGS 1984 Complex UTM Zone 43N.prj projection system which will applicable to all Feature Classes to be created in this Feature Dataset. The Polygon, Line and Point Feature Classes are generated here. The detail process is depicted as below:

Classification:

Classification is the grouping image pixels into categories or classes to produce a thematic representation. Classification can be used in thematic maps or can be further incorporated into digital analysis. It can be performed on single or multiple image channels to separate areas according to their different scattering or spectral characteristics. Digital image classification procedures are differentiated as being either supervised or unsupervised (clustering).

Depending on the type of information to be extract from the original data, classes may be associated with known features on the ground or may simply image is a land cover map, showing vegetation, bare land, pasture, urban, etc. To classify, statistics are derived from the spectral characteristics of all pixels in a process breaks down into two parts: training and classifying (using a decision rule).First, the computer system must be trained to recognize patterns in the data recognized. Training can be performed with either a supervised or an unsupervised method, this present study.

Landsat TM Image (1992):

The classified image of Thematic Mapper (TM) is of year 1992. As per the map 78.87 Sq.km of total study area is Vegetation which is maximum among the classified area, 1.53 Sq.km. of total area is Built-Up area, 18.85 Sq.km. of total area is Wasteland and 0.74 Sq.km. of the total study area is classified as Water Body which is minimum among the classified area. There shows large amount of the vegetation areas and near about wasteland covered area.

Feature	Area in sqkm.	Area in %
Built Up	1.84	1.53
Water	0.89	0.74
Vegetation	94.63	78.86
Wasteland	22.61	18.84
Total	119.98	100

Landsat ETM Image (2000) :

The classified image of Thematic Mapper (TM) is of year 2000. As per the map 92.62 Sq.km of total study area is Vegetation which is maximum among the classified area, 2.18 Sq.km. of total area is Built-Up area, 20.42 Sq.km. of total area is Wasteland and 0.19. of the total study area is classified as Water Body which is minimum among the classified area.

The agriculture area is distributed throughout the study area whereas settlement mostly concentrated in middle, South East, North West and North direction. The Wasteland also distributed throughout the study area. The water body covers minimum area and is in the form of Lake Ekrukh are loss in there.

Feature	Area in sqkm.	Area in %
Built Up	2.61	2.18
Water	0.22	0.19
Vegetation	92.62	77.19
Wasteland	24.51	20.42
Total	119.98	100

Landsat 8 -2014

The classified image of Thematic Mapper (TM) is of year 2014. As per the map 90.33 Sq.km of total study area is Vegetation which is maximum among the classified area 4.47 Sq.km. of total area is

Built-Up area, 19.62 Sq.km. of total area is Wasteland and 0.61. of the total study area is classified as Water Body which is minimum among the classified area.

In their find out built-up areas increasing population factors less space for home there people living isolated pattern settlement and there vegetation developed by the irrigation system and wasteland use in under the trees.

Feature	Area in sq km.	Area in %
Built Up	5.36	4.47
Water	0.74	0.61
Vegetation	90.33	75.28
Wasteland	23.54	19.62
Total	119.98	100

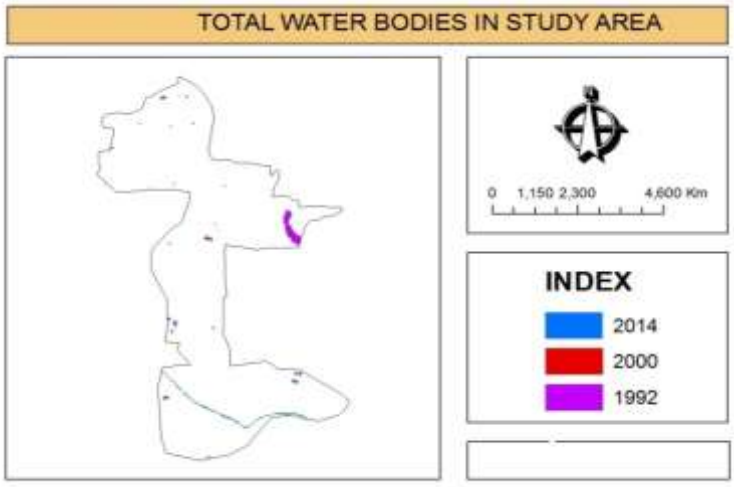
Change Detection:

In comparison images between 1992 and 2000 there are shows difference at positively and negatively .seen that built-up area increase from this area, water body negatively shows decrease of water area and also vegetation decrease negatively on there. Wasteland also positively increases there.

Feature	Area of Sqkm		Difference
	2000	1992	
Built Up	2.61	1.84	1.42
Water	0.22	0.89	-0.66
Vegetation	92.62	94.63	-2.00
Wasteland	24.51	22.61	1.89

Following year 2000 and 2014 built-up area shows positive increasing by 2.74 Sqkm, also water body cover area increase 0.51 Sq.km there are vegetation and wasteland showing at decrease from -2.28 and -0.96 Sq.km.

Feature	Area of Sqkm		Difference
	2014	2000	
Built Up	5.36	2.61	2.74
Water	0.74	0.22	0.51
Vegetation	90.33	92.62	-2.28
Wasteland	23.54	24.51	-0.96



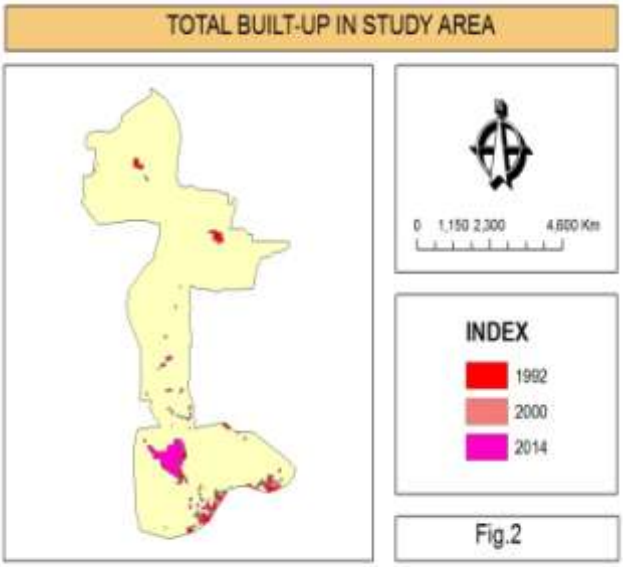


Fig.2

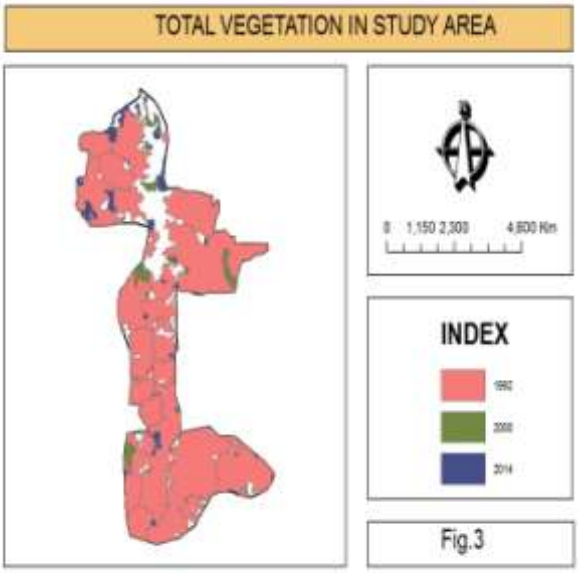


Fig.3

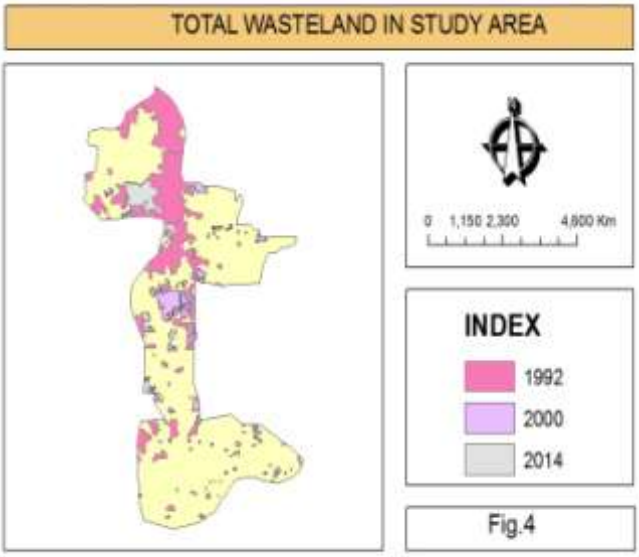


Fig.4

Comparison between 2000, 2005, 2009 in SqKm

Features	Area in Sqkm		
	1992	**2000**	**2014**
Built Up	1.84	2.61	5.36
Water	0.89	0.22	0.74
Vegetation	94.63	92.62	90.33
Wasteland	22.61	24.51	23.54

In 1992 agricultural area was 78.87 % up to 2014 this area is decreased and remains 75.29% of the study area. Simultaneously Built Up area is increased from 1.53 % to 4.47 % in to 1992 to 2014. Because of most of the land is converted in to non agriculture sector so developers are purchased this land and this land is converted in to Built-up. In 1992 wasteland area was 18.85% up-to 2014 this area is decreased and remain 19.62 % of the study area. Water body remains constantly 0.75 % up to decreased 0.62 there are all feature showing positively and negatively

Conclusion

This research work demonstrates the ability of GIS and Remote Sensing in capturing spatial-temporal data. Attempt was made to capture as accurate as possible five wetland cover classes as they change through time. Except for the inability to accurately map out water body in 1992 due to the aforementioned limitation, the five classes were distinctly produced for each study year but with more emphasis on built-up land as it is a combination of anthropogenic activities that make up this class; and indeed, it is one that affects the other classes. In achieving this, Land Consumption Rate and Land Absorption Coefficient were introduced into the research work. An attempt was also made at generating a formula for estimating population growth using the recommended National Population Commission 2.1% growth rate. However, the result of the work shows a rapid growth in built-up land between 1992 to 2014 while the periods between 1992 and 2014 witnessed a reduction in this class.

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