

Regular Article

An analysis of Fringe Suburb Residential Pattern: A Case Study of Madurai City, Tamil Nadu, India

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Abstract

Rapid urban development and increasing land use changes due to increasing population and economic growth is being witnessed in India and other developing countries. The study area comprises of Madurai City and fringe villages. It extends geographically from 9° 50' North latitude to 10° North latitude and between 78° 02' East longitude and 78°12' East longitude. primary data pertaining to the study period 2005-06 have been systematically collected. The JPEG image file has been imported to Map Info 6.5. It is geo-referenced to fit into Map Info 6.5 GIS. These geographically rectified raster image maps are suitably converted to vector data format by means of on-screen digitization, and the resultant vector layer has been edited by using layer editable method. Simple overlay analysis has been performed to prepare final layouts and appropriate results were drawn.

Keywords: Urban fringe, GIS, Cartographic, Raster image. Geo-reference

Introduction

Rapid urban development and increasing land use changes due to increasing population and economic growth is being witnessed in India and other developing countries. The measurement and monitoring of these land use changes are crucial to understand land use dynamics over different spatial and temporal scales. Today, with rapid urbanization, there is increasing pressure on land particularly in the metropolitan cities. Urban sprawl may be defined as the scattering of new development on isolated tract, separated from other areas by vacant land (Ottensmann, 1977). The cities are expanding in all directions resulting in large scale urban sprawl and changes in urban land use. The spatial pattern of such changes is clearly noticed on the urban fringes or city peripheral rural areas, than in the city centre. This has made the fringe area of the city to be the most dynamic landscape. In the modern age of urban expansion 'fringe' is of much significance. The term 'fringe' suggests a border – line case between the rural and the urban and it actually lies on the periphery of urban areas, surrounding it and distinguishing it from the truly rural countryside. The rural – urban fringe, in the real sense is a narrow zone with varying width outside the political boundaries of an urban unit which is neither urban nor rural in character. The fringe of an urban complex forms a pattern depending upon the physiography and transportation facilities of the area. Thus rural-urban fringe zone is an area where various rural and urban characteristics are mixed together. Around major urban centres the physical expansion of built-up areas beyond their municipal boundaries has been very conspicuous. As one moves out of a major city along one of the roads, one observes new residential colonies and a considerable amount of vacant land with partially developed residential land use. A detailed explanation about rural-urban fringe has been given in Chapter Three. An important problem in the rural urban fringe area is the problem of land use. The pattern of land use in the area is dynamic and changes from rural land use to urban land use over short periods of time and distance.

Review of Literature

Aruna Saxena (2000) explains that the fringe zone has complex problems of adjustments in between rural and urban ways of life. This led to serious land use problems, loss of agricultural land, unauthorized urban sprawl, high land values, speculation in land and related problems. For solving these problems, there is an urgent

need of development of an information system. The usefulness of Remote Sensing and GIS in such a situation has been explained.

Pradhan and Perera (2006) studied Bangkok metropolitan region and discussed the relationship between urbanization, industrialization and the continuous exploitation of natural resources such as land and water resources for non-agricultural uses in the urban fringe areas.

Schenk (1993) focusses on the rural fringe around Bangalore city. It is suggested that fringe may be approached from two directions and two perspectives. The first one reflects the urban view of the immediate countryside whereby somewhere a zone of mixing exists while the second one looks the other way round.

Tawade and Phadke (1996) make an attempt to study the urban impact of Bombay on Vasai Tahsil. They identified that the growth of Bombay has caused pressures in rural areas and it is more along the central railway than along the western railway. However, there is spillover along the latter corridor. The process of conversion of land into non-agricultural category is at present slow but would be encouraged with the release of additional areas for urban development.

Richard (1995) studied a large proportion of US cropland that produces high market value agricultural products most of which is within close proximity to fast growing metropolitan areas. Such land is converted to urban land uses within and adjacent to metropolitan areas rapidly.

Nigam (2000) evaluates the effectiveness of High-Resolution satellite data and computer aided GIS techniques in assessing the land use change dynamics in the fringe areas of Enschede City from 1993 to 1998. The methodology adopted involved the visual interpretation of land use on acetate overlays according to land use classification. Satellite images were used for the year 1993 and 1996 at the scale 1:25000. This land use/land cover change analysis using remotely sensed has been applied to discover the trend of development of the rural urban fringe of Enschede city.

Swaminathan (1984) tries to analyse the impact of a growing metropolis on agricultural land use in the Madurai region in Tamil Nadu.

Jothamani (1997) took three major metropolitan cities of Ahmedabad, Vadodara and Surat in Gujarat to delineate major urban land use classes using topographical maps and IRS-LISS II satellite data. He delimited the sprawling suburbs and identified the zones of growth as well as the emerging suburban land uses such as developing industrial/residential cluster and dynamism in rural fringe agricultural areas. These help in identification of typical land use zones and their territorial extent.

Sudhira and Ramachandra (2003) focus on the urban sprawl pattern recognition and explore the causal factors for urban sprawl of Udupi and Mangalore area. Survey of India Toposheets, IRS satellite data and GIS are used for developing a model of sprawl in urban environment.

Study Area

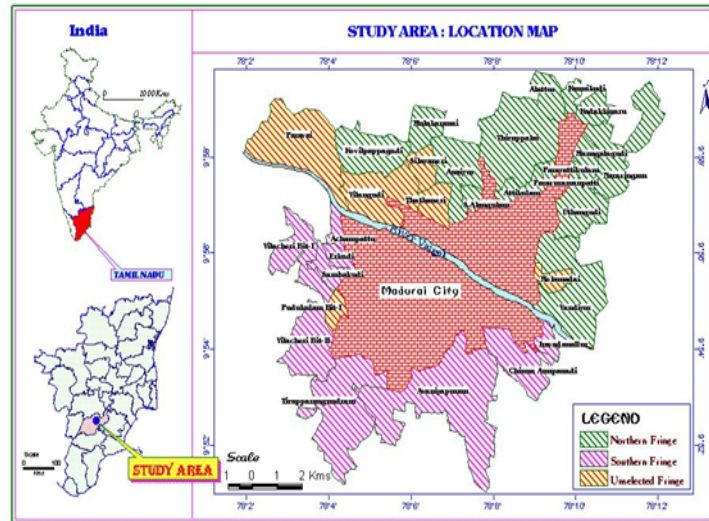
The study area comprises of Madurai City and fringe villages. It extends geographically from 9° 50' North latitude to 10° North latitude and between 78° 02' East longitude and 78°12' East longitude. This city is the third largest city in Tamil Nadu in terms of population. It is located at a distance of about 500 km from Chennai. Madurai city and the fringe villages have spread on either sides of River Vaigai. The River Vaigai is the prominent physical feature which divides the study area

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into two halves. The study area as a whole constitutes 29 fringe villages. Of these 20 villages are in the northern side and 9 villages are in the southern side around the city boundary (Fig.2.1). In the present study only 10 fringe suburbs have taken which are 1)Pandian Nagar. 2) Anaiyur Housing Board. 3)Poriyalar Nagar.

4) E.B. Colony. 5) Lake Area 6.)T.M. Nagar. 7) Muta Colony. 8) Amaithi Poonsolai Nagar. 9) Alwar Nagar.10)Vadivel Nagar. Temperature ranges from 29°C - 38°C and average annual rainfall is 90 cms. The present study area is mostly covered by black and red-soils.

Fig.: 2.1



Madurai city has good transport and communication facilities. The study area comprises the following National High ways: (1) National Highway 7-connecting Dindigul to Tirunelveli via Madurai. (2) National Highway 49-connecting Rameswaram to Ernakulam via Madurai, (3) National Highway 45B-connecting Madurai with Tiruchirappalli.

Data and Methodology

For the present investigation, both secondary and primary data pertaining to the study period 2005-2006 have been systematically collected. The data thus collected are analysed by using suitable statistical techniques and cartographic tools in order to synthesize the spatio-temporal aspects of the present study area.

The present study largely depends on the secondary sources of information. All information regarding land such as ownership and land use are recorded in the revenue register of village called "Adangals". These are available at Taluk Offices and Village Administrative Offices. In this study survey number-wise land use data for 10 fringe areas are collected for the years 2005-2006.

Techniques Used

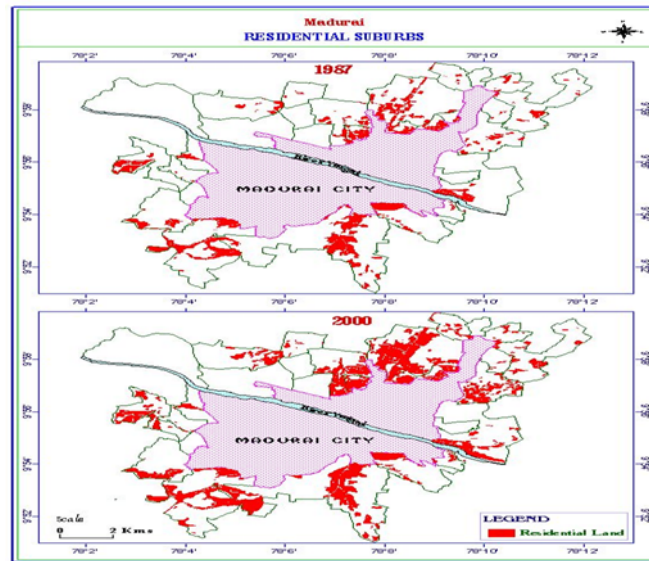
The land use changes are analysed through simple statistical calculation like percentage change and the results derived are cartographically represented using GIS software. The GIS package used for the study is Map Info 6.5. The data collected from different sources has been classified, analysed and converted to tabular form before fixing the module of input into GIS package.

Village maps with survey boundaries have been procured from the Revenue department and the land use maps are generated using the data from village adangal as well as Survey of India Toposheets. The physical aspects of the study area especially the landform conditions and water bodies have been generated from Survey of India Toposheets. All these data in analogue form need to be converted into digital form before they can be given as input into GIS. Hence the generated land uses maps of the study are have been scanned using A4 HP scanner and the image (raster) has been converted into an image file JPEG. This image file has been imported to Map Info 6.5. This imported map in JPEG format has been registered with reference to Survey of India Toposheets on the basis of various Ground Control Points (GCPs) that are derived from the SOI toposheets. The same has been rectified and geo-referenced, to fit into Map Info 6.5 GIS. These geographically rectified raster image maps are suitably converted to vector data format by means of on-screen digitization, and the resultant vector layer has been edited by using layer editable method. Simple overlay analysis has been performed to prepare final layouts.

Analysis of residential pattern of sample suburbs:

The patterns of residential distribution differ among the various socio-economic groups. The socio-economic and cultural forces operate in all urban environments, irrespective of the milieu, and that these forces shift and sort population groups in such a manner that results in the emergence of a particular residential pattern. A perusal of maps (Fig 5.1) depicting growth of residential houses in the sample suburbs in different phases also indicates that the development is purely random and it depends upon the choice of the owner of house.

Fig.: 5.1



(a) Northern fringe suburbs

1.Poriyalar Nagar residential suburb is located near the Madurai-Natham State highway in the Thiruppalai sample village of northern fringe area. It was established in the year 1985. Poriyalar Nagar had followed the pattern of the Alwar Nagar and house construction was found to be comparatively more during the initial decade.(Fig 5.6) Poriyalar Nagar is a colony developed mainly by the technical and other qualified people working in the Public Works Department and in the Water and Drainage board. Therefore this residential suburb was formed in a planned way. This may be the reason for non-residential land use like pubic and semipublic land use and street and road to have a higher share of 43.7% of the total area. Even though this suburb is located near the road more than one fourth of the land is left vacant ,Similar to E.B. Colony here also the plots are allotted only to PWD workers. Transfer of some of them to other places may be the reason for a higher incidence of vacant land.

2.Lake Area is located near the National Highway 45B in the Uthangudi sample village of northern fringe area. It was established in 1991. It had followed the pattern of the E.B. Colony with limited constructions immediately after the establishment of the suburb. This is in spite of the fact that it is located on the National Highway 45B. The main reason for this slackened growth is its nearness to the Corporation Compost Yard where solid wastes were dumped in the open. However, the yard was closed and that area has been demarcated for New Integrated Bus stand and other whole sale markets in the late 1990s. This made a tremendous impact. Further the Ring Road Project by passing Madurai City also contributed its share. Therefore there was a comparatively rapid construction of houses after 2000 (Fig 5.7). Because of this reason this suburb has second highest percentage of vacant land among sample suburbs. Non residential land use like channels and roads etc cover about 30% of the total area.

Fig.: 5.6

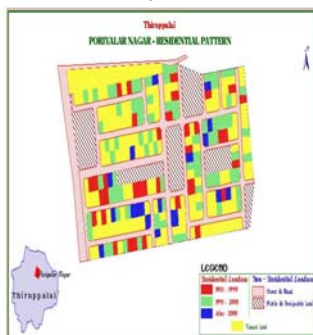


Fig.: 5.7



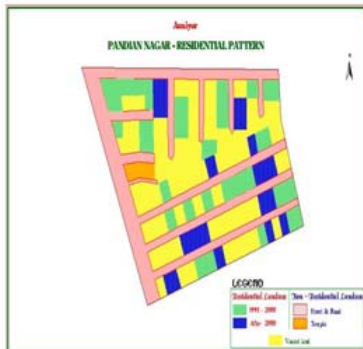
3.Anaiyur housing board suburb is located in Anaiyur town in the northern fringe area and it is located away from the road. It was established in 1992.The Anaiyur Housing Board is a project implemented by the State Government of Tamil Nadu which had constructed a group of houses for the low, middle and high income population and these houses were constructed in the same area. The total number of houses constructed under the project was 643. Of these only184 houses had been allotted between 1992 and 2000 while another 323 houses were allotted after the year 2000(Fig 5.9). It should be noted that still about 20% of the houses remain vacant and unoccupied. Since the houses could be purchased by any person, residing anywhere in the country, absentee house owners are very common. This is supported by the fact that about two thirds of the sample respondents were found to be rent payers. This suburb was constructed by the Government. Hence there was specific allotment for non-residential land use such as schools, open area, parks etc. In fact about 57% of the total area comes under this category making it a well planned residential suburb. Because of this vacant land is very limited here.

4.Pandian Nagar suburb was located near the Madurai-Kulamangalam road in Anaiyur town in the northern fringe area. It was established in 1995 and in its growth pattern it is similar to that of Alwar Nagar. Out of 57 houses about two-thirds of the houses had been built between 1995 and 2000 (Fig 5.10). Non-residential land use and vacant land accounted for 33.2% and 37.5% share respectively.

Fig.: 5.9



Fig.: 5.10



5. E.B. Colony: In the same pattern people working in Electricity Board had established the second oldest sample residential suburb namely, E.B. Colony in 1971. It is located away from the road in Thiruppalai sample village of the northern fringe area. Unlike that of Alwar Nagar, the initial decade saw the completion of only 8% of the houses. Between 1980 and 2000 another 75% of houses have been built in the area. Here also 37.4% of the total area is devoted for various non-residential land use which includes streets, roads, channel and other government land (Fig 5.5). Even though it was established in the year 1971 nearly one-fourth of the total area lies vacant. This might be due to the location of this residential suburb away from the road. Yet another reason may be that the plots are only allotted to people who work in Electricity Board and they might have been transferred to other places. Because of this some plots are kept vacant.

6. T.M. Nagar: T.M. Nagar in the north fringe area had been established in the year 2000 and hence they might be considered as comparatively new suburb. Consequently vacant land has a very higher share in all these suburbs (Fig. 5.11). In fact T.M. Nagar has about 46% of its total area as vacant. It is located away from the main road. Hence it may be expected that growth in these suburbs will be only very gradual.

Fig.: 5.11

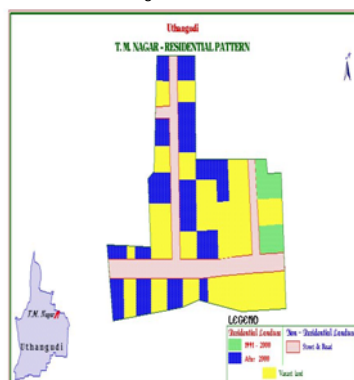
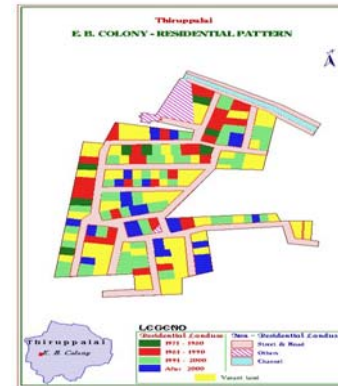


Fig.: 5.5



(b) Southern fringe suburbs

1. Alwar Nagar : Alwar Nagar was the oldest among the entire sample residential suburbs and also it is located along the National Highway 49 at Vilacheri Bit-I village in the southern fringe area. It was established in 1963. A society was formed by a section of the Government employees and through the housing society a large area was acquired and it was divided into a number of housing plots. Construction of houses started in 1963 and nearly 85% of the total number of houses has been built by the year 1990. Thereafter there was a slow down in the construction of houses. Since this suburb is old, about one-third of the total area is devoted for various non-residential land use which includes streets and roads, public and semi public land use, mosque and temple etc (Fig 5.4). Similarly it has the least vacant land (7.7%) among the sample suburbs. All these indicate that this is a typical well developed suburban area with all urban characteristics but located outside the city limit.

2. Muta Colony is located near the National Highway 7 in Tirupparangundram town in the southern fringe area and it was established in the year 1981. It had followed the pattern of the E.B. Colony with limited construction immediately after the establishment of the suburb. Residential growth was more significant between 1991 and 2000 than other periods. Non-residential land use had a share of 28.2% of the total land area. Nearly one-third of the total area remains vacant (Fig 5.8). Like Poriyal Nagar and E.B. Colony residential suburbs, here also, it is developed mainly by the Association of Teachers working in various Colleges located at various parts of the city. Far off location for some of the teachers may be the reason for plots to be kept vacant so that they can build houses at a later date.

Fig.: 5.4

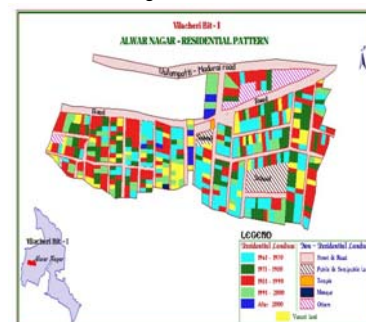
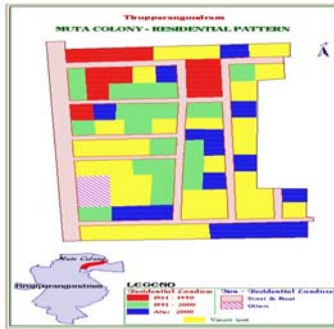


Fig.: 5.8



The remaining other two sample fringe suburbs namely 3) **Amaithi Poonsolai Nagar** and 4) **Vadivel Nagar** in the southern fringe areas had been established in the year 2000 and hence they might be considered as comparatively new suburbs. Consequently vacant land has a very higher share in all these suburbs (Fig. 5.12 to 5.13). In fact Amaithi Poonsolai Nagar has the highest vacant land among sample suburbs while T.M. Nagar has about 46% of its total area as vacant. It should be noted that all these three suburbs are located away from the main road. Hence it may be expected that growth in these suburbs will be only very gradual.

Fig.: 5.12

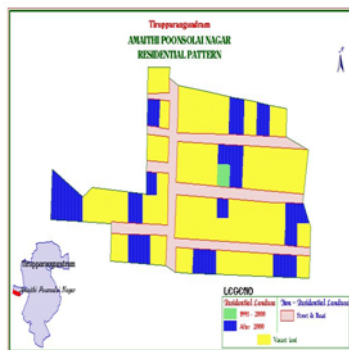
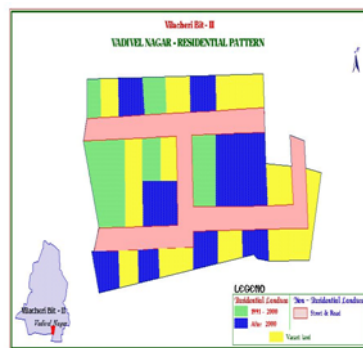


Fig.: 5.13



Major findings and Conclusion

1. The fringe sub urbs Pandian Nagar, Poriyalur Nagar, Lake Area, Muta Colony and Alwar Nagar are located away from the main road.
2. The fringe sub urbs Vadivel Nagar, Anaiyur Housing Board, E.B. Colony, T.M. Nagar and Amaithi Poonsolai Nagar are located closer from the main road.
3. The fringe sub urbs Pandian Nagar, Poriyalur Nagar, Muta Colony, Alwar Nagar, Vadivel Nagar, Anaiyur Housing Board, E.B. Colony and Amaithi Poonsolai Nagar are formed in rectangular pattern.
4. The fringe sub urbs T.M. Nagar and Lake Area are formed in Linear pattern.

The term 'fringe' suggests a border-line case between the rural and the urban and actually lies on the periphery of urban areas, surrounding it and distinguishing it from the truly rural countryside. The rural-urban fringe, in the real sense is a narrow zone with varying width outside the political boundaries of an urban unit which is neither urban nor rural in character. As one moves out of a major city along the roads, one observes new residential colonies, a considerable amount of vacant land and partially developed residential land use. The higher congestion and higher rents in the city drive the city dwellers towards cheaper less expensive areas in the outskirts of the city. The houses built in these areas are large and single family dwellings. An important problem in the rural urban fringe area is the problem of land use. The pattern of land use in the area is dynamic and changes from rural land use to urban land use over short periods of time and distance. Normally the agricultural lands are located to the city boundary along the roads or nearby already developed nodes are demand for residential development and this gets converted first. Though legislation often prevents transformation of agricultural usage, actual enforcement exists only on paper. With such a complex nature, land use changes in the fringe areas exhibit the extent of urban influence over the peripheral rural areas. Much of this land use conversion is towards the development of residential suburbs. The pattern, growth and characteristics of these suburbs vary even for different parts of the fringe areas of the same city. Such suburbs lie outside the political boundary of the city. Hence in terms of amenities, they depend on local administration which have paucity of funds.

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