

# Environmental Impact Assessment in Urban Fringe to Achieve Urban Sustenance

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**Abstract---** *The second half of the twentieth century witnessed rapid industrial growth and progressive wealth creation in most of the developing world. This successive Urbanisation lead to population explosion in haphazard manner in case of developing cities than compared to developed ones. Every city is witnessing an uncontrolled urban sprawl especially in the fringe areas. This paper seeks to understand how recent social, economic and spatial development affected the land use planning tools and instruments that Indian cities have at their disposal. In Indian cities like Nagpur, located in Maharashtra, India, this transformation is more pronounced in southern urban fringe due to rapid horizontal expansion of the city. It is experienced in Nagpur that Urbanisation has triggered the infrastructure development due to proliferation of more number of automobiles on roads. Thus, Paper explores the use of urban growth management techniques at the urban fringe and, more particularly, evaluates the use of urban fringe development as a required method within this region. The focus of the paper has been to collect data and discuss issues and concerns related to the urban fringe areas. This does not imply that development of specific parcels should or should not occur but it should be in compliance with current regulations to be promoted towards Sustainable Urban Development. It is to ensure whether the current annexation and service provision policies are the most effective for managing growth or not? For this purpose Environmental impact assessment has been done to understand the true benefits of residential development within the urban fringe areas. At the end, paper tries to conclude possible solutions needs to be taken into account to achieve urban sustenance.*

**Keywords---** *Urban fringe, Urbanisation, Population, Migration, Sustainable Development, Landuse*

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## I. INTRODUCTION

URBANISATION is a major change taking place at a rapid pace in developed as well as developing world. Developed regions are screening urban population of about 77%, while developing regions are exhibiting only 46% out of

total population (WUP 2011). It is estimated that further 500 million people will be urbanised in the next five years. Projections indicate that 60% of the world's population will be urbanised by 2030 (Doytsher et.al, 2010). With over half of the world's population currently living in urban areas, there is no doubt that the 'urban agenda' will increasingly become a priority for governments everywhere. (Arimah, Jensen, & Mutizwa, 2009). India also has witnessed uncontrolled urbanization in the recent past. It is observed that specific forms of urbanisation are evolving on fringe areas of the large Indian metropolises. These fringe areas are classified into two components, rural-outer fringe and urban-inner fringe together may be called rural- urban fringe. (Proyr, 1968) The critical boundaries are between (a) the continuous built-up area and the rural-urban fringe and (b) the fringe and the surrounding rural areas. (Md. Shakil Bin Kashem et.al, 2006).

Urbanisation extending to fringe areas result in the formation of "mixed spaces", midway between urban centers and rural spaces giving birth to transitory spaces termed as urban fringe areas. Developments within the urban municipal corporation limits are solely responsible for whatever happening to its immediate fringe areas. (Dupont Veronique, 2007) Different variables of land conversions such as the minimum value of the residential land, population density, geographical location and agricultural land capacity are significantly reshaping these urban fringe areas. The urban fringe will be characterised by certain land uses which have purposely moved away from the central core urban area, or require much larger tracts of land. (Hite, 1998) Such landuses are roads, especially motorways and bypasses, Waste transfer stations, recycling facilities and landfill sites, parks and rides, hospitals, power plants, water and sewerage facilities, factories, large out-of-town shopping facilities, etc. Urban fringe may be defined as, those areas surrounding the cities within a daily commuting reach of the city core. In some parts of Asia, these regions can stretch for up to thirty kilometers away from city core. Spatial economic shift occurs in Asia with the chronological evolution of high density and mostly non-agriculture as main occupation growing areas (Veronique Dupont, 2005). The growth of mega-cities and its emerging spatial patterns shows decentralization and dispersal in many Asian mega urban regions. (Rabinson, 1995)

Urban fringe zone is in contiguous contact with the central city. Urban fringe have higher population density than the rural fringe zone. Urban fringe landuse shows higher proportion of residential, commercial & industrial type while the rural fringe signs out as high proportion of farming land as distinct from non-farming. Urban fringe has less commuting distance than the rural fringe to the central city, thereby desired increase in commuting to urban fringe for

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employment. Clear delineation of the Urban fringe ranges in time (age), size of the urban centre, variation in type and degree of zoning control of urban limits. (Doytsher et.al, 2010) The prevailing economic conditions influence the rate of growth and internal characteristics of the fringe (Pryor, 1968). Urban fringe are different from rural fringe as it includes the settlements, their engaged economic activities along with cultural and environmental landscape (Wang Heng et.al, 2006).

Drastic changes in urban growth pattern have been influenced by two major aspects as urban and natural landforms. Dynamism of these urban landforms shows various transitional belts. It consists of the Core areas-the historic city, the Administrative Centre and the Central Business District (CBD) along with their linkages to urban fringes i.e. the last green belt (agricultural area) in the City's outskirts including small villages. These urban landforms shows both the convergence of population towards city core as well as their divergence to the fringes. Thereby urban landforms shows impacts such as declining or growing core areas or the fringe area and lead to evolution of urban fringe areas. While natural landforms acts as a threshold for the urban development in any developing areas. For example, Indian cities governs to have growth radial as in Bangalore, or in linear fashion as in Mumbai or in semicircular as in Chennai and oval shape as in Jaipur, but all of them reflects same concepts of growth leading towards their respective Urban fringes.

Significant transitional socio-economic changes are observed as agricultural production getting replaced by market oriented primary production (Liliana et.al, 2011). More recently the Information Communication Technologies sector has become a prestigious newcomer. Moreover low-density development results in a greater loss of agricultural lands than more compact development. (Anderson et.al, 2001). Migration of new residents to urban fringe in search of employment demands more and more areas to reside. This gives rise to differences in the social, economic and environmental concerns (Dupont Veronique, 2007). All these parameters causing great loss to our valuable urban fringes. Hence urban fringe areas need to be effectively addressed and to be sustainable, that is, environmentally safe, economically productive and socially inclusive.

## II. METHODOLOGY

The study of Nagpur urban fringe areas was done into two parts .First part deals with forms of urban planning in Nagpur Metropolitan region (NMR) plan. It tries to check the evolutionary scenario of Nagpur Urban fringe areas with respect to changes in landuse, demographic trend and environmental impacts. Manonmani et.al, (2011) states that land accessibility and the rate of conversion of agricultural land use to non- agricultural use should form the basis for the selection of the study areas. Thus study of existing NMR plan of 1971-1991 and the proposed NMR plan of 1991-2011 has been explored further with respect to the land use, the settlement structure and the population growth in Nagpur region. Project Appraisal Risk Management (PRAM) analysis was studied for all urban fringe sectors. To delineate the study

area for detailed purpose, the critical appraisal was carried as per the agricultural/no development zone in each sector is concerned. Whereas the second part exhibits the Environmental Impact Assessment through the progressions of urban fringe studies in detail. With respect to the one, the most sensitive urban fringe zone i.e. the south fringe sector has been discussed in details. Change detection (CD) analysis was used to understand the past and present i.e. the transformation scenario. Driving Pressure State Impact Response (DPSIR) analysis was further conducted to frame out the judiciary response. Finally Environmental Impact Assessment (EIA) is prepared to better understand Urban Sustenance of these urban fringe areas.

### A. PART I- About the Study Area: Nagpur Metropolitan Region (NMR)

More pronounced non agricultural growth is taking place all around Nagpur Municipal Corporations (NMC) limits in about 76 villages. These areas may be classified as immediate Urban Fringe areas and are grouped into 4 sub areas namely North, South, East and West sectors. (Ref.Fig:1) The municipal towns of Kamptee, Kalmeshwar, Mouda, Butibori were also coming as the fast growing growth centers with number of high tech, polyester, cement and engineering industries. Hence keeping in the view of land capabilities, for the planning purposes, the Nagpur Metropolitan Region plan (1971-1991) has been sub-divided into following sub-areas.

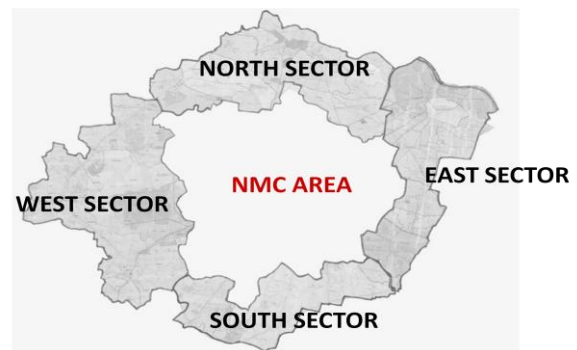


Figure 1: Map Showing Major Sectors of Fringe Areas of NMR with NMC Area

- Nagpur Municipal Corporations(NMC) area
- Fringe areas having 76 villages subdivided into 4 sectors i.e. North, South, East & West Sectors
- Kalmeshwar,
- Kanhan Kandri
- Chicholi, Saoner, and
- Rest of the rural areas comprising of 1800 village

### B. Section 1: Critical Appraisal of Nagpur Fringe Sectors

Nagpur peripheral areas are experiencing tremendous socio-spatial changes. Table:1 discuss in detail about all four urban fringe sector through Project Appraisal Risk Management (PRAM) analysis. PRAM analysis is conducted with respect to each sector financial stability, economic benefits, risk aspects, environmental sensitivity and allocative

behavior. PRAM helps to select the most vulnerable urban fringe sector for the actual study area in detail.

Table 1: Project Appraisal Risk Management analysis of all Fringe Sectors of NMR

	ANALYSIS	EAST SECTOR	WEST SECTOR	NORTH SECTOR	SOUTH SECTOR
1	Financial				
a	Stability	Sustain for some time	Sustain for longer time	Sustain for longer time	Sustain for longer time
b	Profitability	No pull for business	Higher level business	Less pull for business	Higher level for business
2	Economic				
a	Cost Benefits	Low-Small Industrial & Godown activity	High-Big industrial zone in New Nagpur, MIDC, Defence depot	High- Koradi Thermal Power generation station & Mining zone	High-Higher land values due to MIHAN & Butibori –better jobs
3	Risk				
a	Quantitative	Huge Reserved cantonment area	Gorewada lake catchment area	Mining zone	Unauthorised layouts sprawling on agricultural zone-need to be managed
b	Qualitative		Congestion in New Nagpur	High Air pollution level due to MSEB location	High capacity cultivable land-need to be preserved
4	Sensitivity				
a	Environment or Locational sensitivity	Sewage Farm, Kamptee cantonment	Parks & Playgrounds near Dighodh/Wanadongri, Suraburdi lake, Forest area -Catchment of Gorewada lake, Afforestation zone	Higher-Presence of religious area -Koradi Temple, Power Plant & Mining activity	Greenways along the Nallah, Two Parks along Dahegaon & Telhara tanks-needs to be rejuvenated, MIHAN, MIDC & Airport areas.
5	Allocative				
a	Natural resources/ Storage		Catchment area of Gorewada Lake, Afforestation zone	Stone quarries, Canals for irrigation, Coal mining by WCL	High agricultural cultivable land
b	Labour force		Higher- pull due to main industrial hub of the city	Higher- pull due to Power plant & mining	Higher- due to Butibori & MIDC, Truck terminus on Wardha road
c	Production output	No industrial activity proposed	High Production capacity	High Production capacity	High Production capacity- Bottling plant of LPG, Oil depot of Indian oil, Cotton research centre

From the PRAM analysis the Western and Southern sectors are showing more pronounced urban development (Ref. Table:1). Whereas The Eastern sector have highest of 72.31% share in agricultural land (Ref. Fig:3). Though Southern sector occupies smallest of all fringe area, (Ref. Fig:2) it also have second highest i.e. 68.15% share of agricultural land (Ref. Fig:3). Both these Eastern and Southern sectors reserved higher level under agriculture land and are proved to be more environmentally vulnerable. Thus a comparative analysis is done for East and South sector of both the NMR plans i.e. 1971-1991 & 1991-2011 with respect to residential and agricultural land provisions.

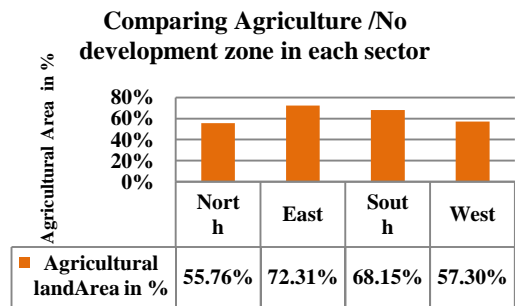


Figure 3: Agricultural zones of Fringe Areas Sector Wise

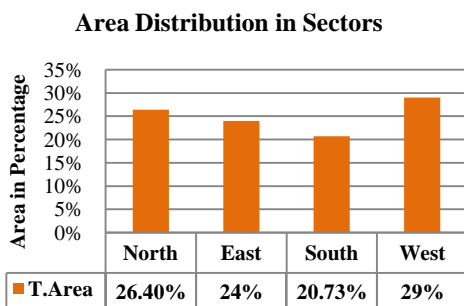


Figure 2: Fringe Area distribution sector wise

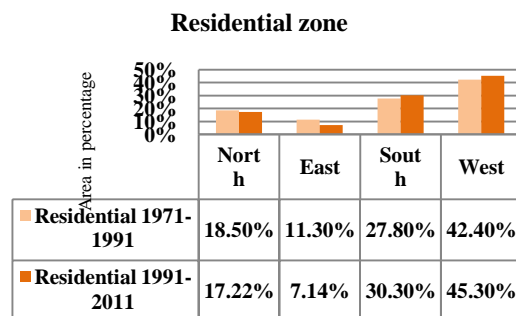


Figure 4: Comparison of Residential Zone (Nagpur Regional Planning Board, 1994)

**Agricultural & No Development Zone**

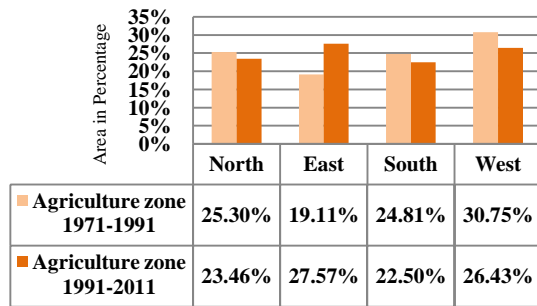


Figure 5: Comparison of Agricultural & No Development Zone

Residential area provisions, (Ref.Fig:4) shows prominent reduction in East sector zoning and in South sector zoning it is provided more than previous. Whereas agricultural area provisions (Ref.Fig:5) in East sector zoning increased than in previous, while the same has been reduced in South sector. From the NMR provisions it is clear that Kamptee contonment situated in East sector is more than half of this sector itself. Also Kamptee contonment is governing no development provisions in Eastern sector. Thereby the contonment norms are directly facilitating the protection of valuable greenwedges. It is clearly proposed in Regional Plan (1991-2011) that no residential or industrial development to be further carried in this sector. Here South sector is exposed to much more vulnerable changes of decreasing green zones threatened by unauthorised layouts. Thus unauthorised layout sprawling on agricultural zone and eating up the biggest capable resources.

This unprecedented Urban sprawl needs to be taken care of in order to conserve such resourceful land to achieve urban sustenance. So there is an urgent call to conserve the potential land in South Fringe Sector as East Fringe Sector is already protected through regulatory norms. Finally after a brief comparison of all these sectors, Southern fringe sector is found to be highly sensitive and mismanaged. Proper Planning and management through policies needs to be implemented to protect at least the remaining agricultural land being misused. Also the controlling policies need to be mandated on unauthorized layouts. Otherwise un-authorization will become a norm in these fringe areas. Hence South Fringe Sector is selected to be the detail study area.

*C. Part Two-Environmental Impact Analysis*

*Section 2: Environmental Status of South Fringe Sector*

Nagpur Municipal Corporation environmental status report further discussed to understand the viable limits of South Fringe sector. It states the south sector physiography have alluvial plains, with more than 61% of land have black cotton soil. Land Capability shows south sector consists of 76% highly capable land for cultivation (Ref.Fig:6). Geology of this sector shows deccan trap, while surface drainage in Pora river actually flows outside the NMC limits. It has two lakes namely Telhara & Dahegaon lake, so have good water resource.

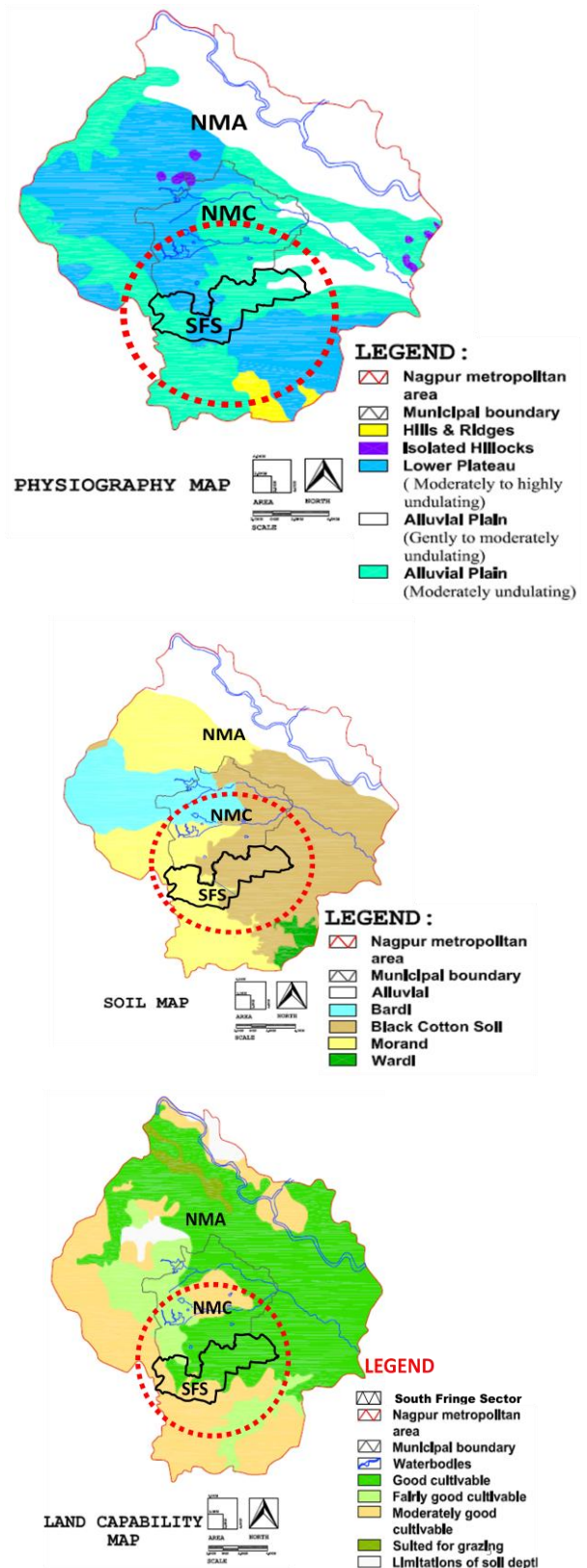


Figure 6: All Environmental Status Maps Highlighting the South Fringe Sector (SFS), the Nagpur Municipal Corporation area (NMC) and the Nagpur Metropolitan Area (NMA) [Source: Environmental Status Report, NMC, Nagpur] (Nagpur Municipice Corporation, 2001)



From the above study, many interesting and useful findings regarding the urban growth development in south sector were concluded. Since we are at the end of the NMR plan (1991-2011) now in 2012, the urban development governing bodies and Nagpur improvement trust are on their way of preparing the existing status report through surveys. So there is no further publication available for the study to proceed. Hence further the study is processed through Change Detection (CD) Analysis with the source used as Google Earth images.

*Section 3: Change Detection (CD) Analysis*

Change Detection (CD) analysis is very useful to understand the progressions in the developmental trends within specific interval of time. It is a powerful tool used by Geographical Information Systems (GIS) and Remote Sensing (RS) organisations, to study the transformation scenario through the basic factors as time and scale. CD acts as the best spatial decision support system. To understand the present status of south fringe sector CD carried further for housing, industrial, transportation and water bodies current settings.

*Housing in South Fringe Sector*

Change detection shows housing development from Feb 2000 till June 2010 (Ref.Fig:7).It shows encroaches upon agriculture zone leads haphazard & unattended urban sprawl. The changes are shown with a time gap of nearly ten years. In south fringe sector two types of housing development are seen as authorised and unauthorised.In authorised layouts mostly land owners obtained Non-Agriculture (NA) permissions and procure layout approval from Town Planning (TP) department. As per MRTP act 1966, conditions for development of infrastructure facilities i.e. roads, sewer line, storm water drain, etc have instructions that 20 % of the plot should not be sold unless stipulated work is completed. But on the other side many plots were sold by means of other instruments i.e. Power of attorney, unregistered agreements, etc. without NA.



Figure 7: Besa Residential Area (From Feb 2000 to Dec 2010)

Moreover few builders have taken up some stipulated development work in their layouts having no basic amenities like roads, sewer line, storm water drain, water supply, electrification, etc. In May'2005 Besa-Beltarodi Improvement Scheme (towards East of Wardha road) comprising total area of about 875.00 Ha was first notified by Nagpur Improvement Trust (NIT). But prior to notification, lot many unauthorized sale and purchase of plots /lands have taken place. Due to increase in land acquisition cost and public opposition it was not economically viable to implement this scheme. Hence the scheme was not even sent for the approval to the Government of Maharashtra. Towards the end of 2008 many constructions were started coming up in Besa Beltarodi

area. Besa-Beltarodi areas were recently in news for violation of the Development Control Regulations (DCR) and Floor Space Index (FSI) norms. It is seen that there was no designated planning authority for the Besa Beltarodi area. The sanction of the building plans was accorded by the Gram panchayat. There was no control on building construction and infrastructure development. Thus lots of unauthorized construction has come up in this area.

*Industrial areas in South Fringe Sector*



Figure 8: Industrial Zone Near Amravati National Highway Road (From May 2002 Till Dec 2010)

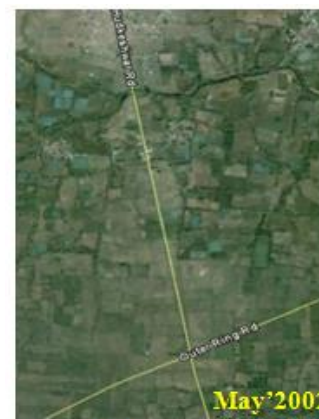


Figure 9: Transportation Network in Hudkeshwar Area (From May 2002 till Dec 2010) Connecting Inner and Outer Ring Road

Fig: 8 displays the CD with a time span of nearly eight years, the housing and Industrial development along the highway road, as new proposed roads gives better connectivity.Changes are seen in existing employment sites to the proximity of adjacent land uses and their viability.

**Transportation network in South Fringe Sector:**

CD showing the framing of roads and then within time span of nearly eight years the new completed networks. It shows promotions in housing and commercial development wherever accessibility is provided.(Ref.Fig:9) From the existing Transport status report, the traffic composition, its intensity, its pattern of passenger and the main trip purpose at the outer (peripheral) cordon count stations have been referred. The report states the tendency of the developmental inclination that the moment road layout provisions are laid, corridor development begins to evolve.



Figure 10: Telhara Lake, Feb 2002, May 2005 and Dec 2010

Through the Change detection, there is reduction in the size of the Telhara Lake (Ref.Fig:10). As water is an important resource, formation of hutments for agriculture near the lake was observed. South sector is facing issues of Lakes and are often the main targets of adverse effects of nearby development. Due to pressure of human activities, built-ups coming up abutting the rivers, along the lake and its catchment areas. Huge construction of buildings cuts the surface drainage pattern, thus facing major drainage problems.

**Section 4: Driving Pressure State Impact Response Analysis (DPSIR)**

The Current status of south fringe sector exhibit the driving forces such as the most vibrant demographic trends, their relative economic activities and their available resources. (Ref.Fig:11) The pressure has been seen on the existing as well as on new structures, their landowners and the transformation of its landuse. As per these driving forces and pressure trends urban fringe state is quite dramatic showing expansion of highways and other roadside buildings, whose tremendous impact is on housing, their communities and their associated land values. These are the areas where the sub-urbanization, counter-urbanization, and gentrification (less present in rural) takes place. (Liliana et.al, 2011) All these impacts needs to be taken care by responding properly through landuse planning and management.

An alarming situation is sensed through the DPSIR analysis as it shows direct effect of urbanization within the city and its immediate shadow effect on its urban fringe areas (Ref. Fig:12 & 13). To take an urgent and fast step towards proper urban sustenance, the impacts of urbanization are listed down for further understanding toward Sustainability.

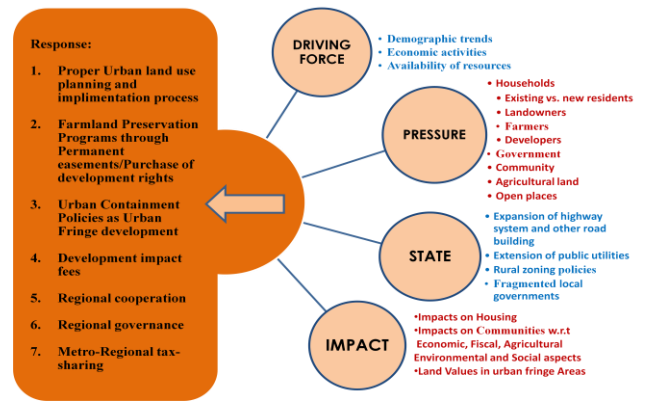


Figure 11: DPSIR Analysis to Frame Out the Judiciary Response

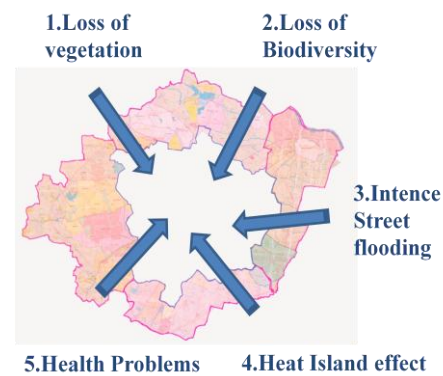


Figure 12: Effect of Urbanization within the City

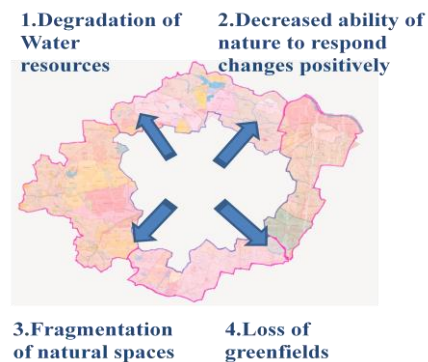


Figure 13: Effect of Urban Development on its Fringes

These impacts are:

**Social Impact**

- Loss of community quality of life
- Less leisure time due to longer commuting distances
- Unhealthy conditions due to air and noise pollution caused by traffic congestion
- Flashy commercials
- Loss of green spaces
- Weaker infrastructural facilities

GROWTH ISSUES	ENVIRONMENTAL ISSUES	IMPACTS	POSSIBLE SOLUTIONS
Traffic congestion	Air pollution	Increased smog and other pollutants, Increased health impacts such as asthma	Improved transportation, land use planning, Mixed use development, Mass transit,
	Public safety	Increased response times for fires and medical emergencies	Traffic congestion and relief efforts, Public education
	Energy use	Wasted petroleum	Use of Improved renewable resources,
Urban demographic growth	Contaminated land and buildings	Increased human exposure to toxic environment	Brownfield development projects
	Public infrastructure	Decreased maintenance and greater services interruptions for water, sewer, road repairs and solid waste management.	Urban revitalisation , Housing schemes using density as a sustainable tool for planning, Revenue sharing with suburbs, Stronger regional planning
Haphazard expansion of suburban communities	Water runoff	Increased pollution of streams, rivers and marine environments, Increased flooding, Loss of biodiversity, Soil erosion, Decreased recharge of aquifers, Lower drinking water quality.	Coordinated land use planning, More compact communities, Green space buffers and Preservation of water shed protection
Poor land use planning	Consumption of open spaces	Loss of contagious green spaces and natural habitat of native species, Loss of wetlands, Fragmentation and loss of farmland, Increased flooding, Less access to recreational areas, Higher increased in temperature-heat islands	Land preservation, Priority development areas, Urban Growth boundaries, Purchased development rights, Higher fees for developers, Expanding open space in urban areas, Strong and consistent zoning regulations, Promoting Public awareness

*Economic Impact*

- Availability of cheap labours
- Large tract of land available for bigger projects
- Low land values compared to that in core areas
- Increase in single vehicle ownership to cover longer distances, hence creating pollution and congestion thereby increase in the expenditure cost

*Environmental Impact*

- Loss of green cover, prime agricultural land
- Degradation of natural resources i.e. depleting ground water and air quality, and loss of wildlife habitat
- Due to run-off of construction site, fuel spills, oil leaks, pesticides used for faster growing crops leads to water pollution

Environmental Impact Assessment (EIA), are the widely used methods for assessing viability of any development plan or proposal (Md. Shakil Bin Kashem et.al, 2006).Table:2 above displays Environment impact assessment to

comprehend the scenario of urban growth issues and their possible but urgent solutions to progress towards Urban Sustenance (Ref.Tab:2).From the detail study of entire South

Fringe Sector it is reviewed that there are growth issues (listed in the table.2) related to urban developments in this sector. These developments may be planned i.e.as per the

regulatory norms while some of them are the cases of encroachments on agricultural green cover. Precautionary measures needs to be taken while locating developmental growth pockets in planning process. Also Green travel plans to be implemented in planning and management process to encourage alternative modes of access to places of work.

III. CONCLUSION

The study herein summarized Urban South Fringe Sector in detail to serve as a checklist and control of findings of Nagpur Metropolitan Region’s urban fringe areas. The basic objective of this paper is an analysis to list out the human interventions which results from various phases of urban growth issues. Rapid growth of the cities has led to a skewed pattern of urbanization. This lead to spread of urban growth around the outer ring road and creating a strong footprint in urban fringe areas. The urban fringe growth seems to be impacted by cheaper land availability and thereby promoting continuous Urban Sprawl. It can be concluded that the tendency of urban centres, usually to push out their problems in the urban fringes, causes great loss to the greenfield landscapes. The evolution and transformation of urban fringes are characterized by those settlers which are migrants to the cities from rural poor and became the urban poor in the city. Finally they ended up with their resettlement from the city, back to the urban fringes due to expensive lands in the city centre. These zones are having weaker infrastructure, poor urban services and amenities. They host the polluting and

heavy industries which have been evacuated from urban centres and thus possesses a degraded environment. As urban development continues to expand in an unconstrained form, as currently experienced within Nagpur, significant portions of land in the urban fringe are being stretched to their viable limits. Hence urban fringe areas are, in fact, complex structures resulting from a mix of planned operations to unplanned and uncontrolled processes with the flouting of regulations.

Thus through the environmental impact assessment, problems need to be investigated and addressed through proper implementation of policies. Need of an hour is to ensure that urban expansion does not result in permanent disbenefits to our cities. It is concluded that to address these issues, there is a need to govern Urban Fringe Development as a tool to be implemented for desired growth management in fringes. Before framing any strategy for Urban Fringe Development, a review of Development Control Rules has to be made in brief, to understand the scope and limitations of legislative norms (Zerah, Feb 2007). Hence there is a need to establish a special planning authority in each zone to better control on such unwanted & unauthorized growth. (Ben C. Arimah et.al, 2009) In India, the use of urban growth boundaries as a growth management tool appears to have comparatively small although not in existence in urban fringe areas (Barton, 2007). This paper has aimed to fill the gap by suggesting the use of an urban growth boundary strategy as suggested in EIA solutions previously, a successful planning tool to be potentially implemented to manage growth within the Nagpur region. The current status of Metropolitan planning, Nagpur is on its stage of framing the Master plan in the near future. This paper attempts to serve a starting point for further considerations to be included in Urban growth management, basically in urban fringes....our most valuable assets.

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