



An Overview of Multidimensional Drivers and Adverse Impacts of Urban Sprawl

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Abstract

The aim of this paper is to enhance the current knowledge and understanding of the causes and consequences of multi-dimensional issue like sprawl with the perspective of achieving sustainable management of urbanization. The mitigation and management of this phenomenon require a comprehension of dynamics of sprawl causing factors as well as analysis of consequences especially on environment and human health. The past research works of both developed and developing countries have identified the drivers of urban sprawl as population growth, rising incomes, dominance of private cars, range of inner city problems, people's desire of living with nature, failure of urban governance, fall of commuting costs and finally growth of ITC. This paper also covers the impacts of urban sprawl such as encroachment of crop land, grass land, open spaces, lowering of water table, traffic problems, loss of biodiversity, obesity, diabetes, hypertension, cardiovascular problems etc.

Introduction

Urban Sprawl is one form of land use and land cover change in which rural areas are transformed into urban area. It is driven by population growth mainly migration from rural areas, rise of income, inner city problems, desire of living with nature, investment plans, failure of urban governance and growth of transportation and ICT etc. Sprawl is irresponsible and poorly planned development that destroys green space, increases traffic, contributes to air pollution and it does not contribute significantly to revenue (Joshi and Bhatt, 2011). Increased urban sprawl if not reversed might cause greater social and environmental problems in the coming days (Usman *et al.*, 2018; Wolff *et al.*, 2018). A transitional zone of low dense residential and non-residential built up in between core

city and vast rural countryside (Rural-urban fringe area) is needed to be kept in continuous observation as it is rapidly undergoing changes due to real estate industry and growth of housing demands at faster rate. Understanding the causing factors in this regard is vital as regional sustainability is under great threat. Mitigation and management requires a comprehension of sprawl causing factors as well as analysis of consequences on environment and human health.

Urban growth identification, quantification and the knowledge of rate and trends of growth helps in determining the changes associated with land use and land cover properties and in regional planning with better infrastructure in environmentally sound way. Understanding the dynamics of urban growth is vital to resource management, to improve the quality of life and to continuous monitoring of the sprawl (Guptal, 2013). Urbanization dynamics is analyzed by accurate and timely information in geo-spatial forms that allows generation and use of different maps, GIS data and applications (Malik *et al.*, 2013; Sankhala and Singh, 2014). The integration of remote sensing and Geographical Information System technique acts as an effective tool for detecting urban growth and modelling (Ohri and Poonam, 2012; Deka *et al.*, 2012). The purpose of this review article is to enhance the current knowledge of multi-faceted sprawl phenomenon and dynamics of causative factors and their implications. This review particularly focuses the causes and consequences of sprawl in the context of effective monitoring and sustainable management of urbanization. The different causes and consequences of urban sprawl are reviewed as follows:

Causes of urban sprawl

Population growth: Unchecked urban population growth as a result of natural population increase and migration from rural to urban areas cause cities to sprawl. Population growth is one of the most important engines of change in any urban system and this is also true of sprawl. The expansion of a city beyond its periphery requires, at a minimum, population growth and/or spatial redistribution of that growth. There are at least three ways in which population growth has contributed to sprawl: absolute growth, increasing urbanization and restructure of dynamics of household demography (Torrens, 2006). Population increase is one of the driving forces of urban sprawl, which will lead to possible considerable impacts on surrounding environment in Vadodara city and also in North East India (Joshi, 2011; Deka, *et al.*, 2012; Antonio, 2014). The total population of Omdurman city is increasing rapidly depending mainly on displacement, migration and natural population growth (Mohammed *et al.*, 2015).

In addition to population growth, other demographic factors may however, increasingly have impacts on urban sprawl. Families with small children are most likely to move to suburban areas and to rural areas outside the city. In contrast, the elderly and single are least likely to move out of cities. As the trend towards an increasingly ageing population and smaller households continues, it may be anticipated that some slowing

down of the movement from cities to suburbs will occur in the coming decades (Couch & Karecha, 2006). However, population growth no longer determines the outward expansion of built-up areas (TRB, 2006).

Economic factor or rise of income: The rise of income owing to rapid industrialization and growth of service sector cause people to search new locations for housing. Generally, there is rapid development of economic and commercial activities along the roads and highways which attracts people to work and settle there. Rising incomes are an important factor in driving the suburbanization of population. Richer countries had less dense cities and that the coefficient on income is at least as important as the coefficient on vehicle ownership. Both the rising incomes and automobile ownership were necessary for cities to sprawl. Without rising incomes, people would not have had the money to pay for all those automobiles. However, without the automobile the car-based edge cities would really be impossible (Glaeser and Kohlhase, 2003). Another factor that has surely played some role in explaining the increasing suburbanization of population is the demand for larger suburban lots (Glaeser and Kohlhase, 2003).

From the perspective of land economics, high land prices in the core city force the developers to seek lower prices land in the peripheral areas. The price of agricultural land is universally much lower than the price of land zoned for housing or the development of services. Agricultural land therefore becomes a highly attractive target for investors and developers. Although planning permission for non-agricultural development increases the value of agricultural land substantially, its price still remains at much lower levels than land in the core urban areas (TRB, 2006; Christiansen and Loftsgarden, 2011). As prime investment, Europeans favor to own a semi-detached or detached house in the suburban/rural areas, because land prices are generally lower than in the core and the value of property is expected to rise more rapidly (Couch and Karecha, 2006; Wu, 2006).

Inner city problems: The unlimited outward extension of new development is the range of problems faced by the inner city dwellers such as high land price, high cost of living, pollutions and traffic problems etc.

(A) Low quality of life: The attractiveness of living in the center of cities has fallen while the quality of life associated with city suburbs, being closer to nature, has increased (TRB, 2006). As families move out of the city, social segregation begins to intensify. Municipal tax revenues are lowered which is insufficient to maintain services such as schools and hospitals. The quality of schools plays a crucial role as parents try to secure the best education for their children. In the inner city a downward cycle of deprivation can readily become established as more and more people attempt to move out, reinforcing the problems of those that must remain (Burton, 2000; Couch and Karecha, 2006).

(B) High land prices: Urban sprawl is largely a consequence of the extremely low price of agricultural land in the vicinity of cities compared to already urbanized land or former

industrial sites is an important factor underlying urban sprawl. Land prices of already urbanized areas are relatively high. In many land development projects or layout formation the cost of agricultural land acquisition is relatively low. It enables greater profits to be made compared to those from already urban land (TRB, 2006). The downtown's pull on location has also been weakened by the growth of the highway system. No longer indebted to central cities as interchange points for raw material and finished goods, industry has diffused rapidly through the city to the suburbs, following its labor forces and pursuing cheap land and easy access to an expanding network of interstate highways (Torrens, 2006).

(C) Social problems: The growth of the suburbs has become rapid as well as massive because a range of social problems of the inner city such as poor environment, social problems and safety issues etc. Millions of people have been directly motivated to flee to the suburbs by the desire for a more attractive social milieu. Moreover, lack of downtown amenities has also spurred suburbanization. Decentralization may increase in the metropolitan areas with more poverty and increased crime may cause the suburbanization. There have been more sprawls in more troubled cities (Glaeser and Kahn, 2003). In contrast to the apparent attractions of the suburbs, many as more polluted, noisy and unsafe than the suburbs perceive city cores. The built up environment is also considered unattractive because of poor urban planning, with areas lacking green open space and sports facilities etc. Unemployment, poverty, single parent households, drug abuse and minorities with integration problems are also often identified with inner-city areas. These negative environmental factors drive many families with small children out of the city (TRB, 2006).

Desire of living with nature: The increasing trend of people desirous of living with nature is also seen as a major driver for settling in the peripheries of cities. People who move into the suburbs are motivated to a significant degree by the desire for more living space (Glaeser and Kahn, 2003; Christiansen and Loftsgarden, 2011). This applies particularly to young couples with children. They want to establish themselves in more rural residential areas with large lots and access to green areas. This may partly be because housing prices are lower outside the urban areas and that families can fulfill their desire for a bigger house than they would be able to afford in the city as well as access to gardens or green areas in relation to housing (Christiansen and Loftsgarden, 2011).

Failure of urban governance in execution of planning: Improper planning and execution of infrastructure projects, maintenance of civic amenities, layout formation and lack of proper checks and balances by local administration is one of the causes of urban sprawl. Municipalities and public development agencies have a crucial role in the process of conversion of agricultural or open space for housing or commercial development. Thus, competition among municipalities for new income generating jobs and services is great and many municipalities can be tempted to relax controls on the development of agricultural land and even offer tax benefits to commercial and industrial enterprises to

invest in the municipality. Competition of this nature between municipalities fuels urban sprawl (TRB, 2006; Christiansen and Loftsgarden, 2011).

As it is often the case, the lack of urban planning forced immigrant to settle in the periphery of the city where land and accommodation prices were much lower than in the city center. The economic factor or the differential land rents thus appears as a major driver of urban sprawl in Lucknow city (Kumari, 2015). Government often themselves through their policies and planning encourage sprawl. Firstly, governments purposefully through their favoritism of the automobile and through other anti-urban policies pushed people out of the central cities into the suburbs. Secondly, local governments create sprawl works through the zoning process (Glaeser and Kahn, 2003). Ineffective implementation of land use planning is one of driving forces of sprawl which will have a considerable impact on surrounding environment in Vadodara city and in North East India (Joshi, 2011; Deka *et al.*, 2012). The policy and regulatory framework plays a major role when it comes to driving forces behind urban sprawl. This also applies when it comes to controlling and reducing urban sprawl. Countries with a strong control over land use policy and with less dispersed and fragmented governance system, have the best potential for managing and planning land developments. It is also important to point out that cities or municipalities may promote urban sprawl, because it is in their interest to do so. Some municipalities may facilitate urban sprawl to attract new inhabitants and increase the population (Christiansen and Loftsgarden, 2011).

Transportation: Investment in longer distance transport networks to facilitate improved accessibility and mobility, investments on infrastructure provision can either drive sprawl or support its containment and investment in new motorways and other road connections readily attracts new development along the line of the improved transport links, frequently exacerbating urban sprawl. The inter-linkages between residential and industrial/commercial/transport areas in urban development are critical to the promotion of sprawl (TRB, 2006). New transport investment, in particular motorway construction, can be a powerful stimulant for new development and sprawl, including shopping centres and residential areas. Land use and transport are inter-dependent in complex ways as development influences mobility patterns. New suburban development without adequate public transportation typically increases the demand for private car use (TRB, 2006). Households make choices between residential areas taking into account the price of housing and the price of commuting between the work place and home. When travel costs fall below a certain threshold and income reaches a certain level the rate of sprawl quickens and naturally sprawl is more common in regions where incomes are high and commuting costs are low (Wu, 2006).

Prolific use of automobiles facilitates disperse the activities, making lower densities possible. This has been reinforced by a long-term trend of decline in gas prices in the United States. This has allowed households to substitute housing for transportation costs by moving to the suburbs and living at lower sprawl-type densities (Torrens, 2006).

Sprawl is not the result of explicit government policies or bad urban planning, but rather the inexorable product of car-based living. As transportation costs fall, it unsurprisingly becomes more attractive to live at further distances and commute further (Glaeser and Kohlhase, 2003).

In sprawled metropolitan areas, people use their cars to do everything. We find a positive correlation between low-density cities and car ownership. Places that make it difficult to own cars have much less sprawl. This serves as evidence to show that sprawl is dependent on the automobile (Glaeser and Kohlhase, 2003). A direct relation between increase in settlements and population expansion is observed along the main transportation routes (Ohri, *et al.*, 2012; Silambarasan, 2014). Transportation related factors are prerequisites behind urban sprawl. Train, metro, bus and car have provided greater freedom and opportunities with regard to localization of individuals, businesses and industry. Technological improvements and falling transport costs have made it possible for businesses and industries to locate away from transport hubs such as railway stations and ports. Moreover, it has become possible to travel longer distances within the same travel time. Therefore, one can live farther away from the center or the workplace without increased travel time (Christiansen and Loftsgarden, 2011).

Information and communication technology: Internet and communications technologies may well reinforce the trends of urban sprawl. There is general agreement that technological advances have greatly extended the effective radius of the city (Gordon and Richardson, 1997). Ability to work while commuting and compensation for travel time as part of work time may reinforce incentives to live further away from centers and place fewer restrictions on mobility (Christiansen and Loftsgarden, 2011).

Consequences of Urban Sprawl

Reduction of open space, forest and agricultural fields: The scattered settlements require more numbers and length of roads and related infrastructure causing more paved surface. Reduction of vegetation and grass cover decreases underground water recharge caused by more runoff of rainwater. Urbanization shows that built-up area is increasing at very fast rate and acquires the area of cropland, grassland and wasteland and this changing pattern is alarm for natural environment (Shalaby, *et al.*, 2012; Singh, 2014). Encroachment of water bodies due to urbanization in major cities led to drying up and pollution of water bodies that are later converted into parks, which are highly conducive for groundwater recharge. The loss of these water bodies due to urban sprawl is a critical factor in the lowering of water table resulting in water crisis (Ramachandraiah and Sheela Prasad, 2004). Urbanization resulted in the loss of agricultural land in Hyderabad and the associated reduction in food production is irreversible and this burden has shifted to the surrounding area. The urban sprawl also has impacts on the urban weather profile in terms of expanded heat islands and temperature differences (Gumma, 2017).

In Monavale area of Harare, a loss of the wetland area due to fragmentation and human activities like housing development and crop cultivation showed that the biodiversity of the area is negatively affected and also disturbs animals and birds since their habitat area will have been reduced (Murungweni, 2013). New urban along the coastal watersheds of Lake Michigan have become hydrologically impaired from the increased amount of imperviousness from urbanization, resulting in habitats loss along major rivers threatening the sustainability of wildlife populations (Pijanowski, *et al.*, 2002). Soil sealing induced by urbanization has been considered as a serious threat to soil fertility, environment and food security. Rapid urbanization process in Changchun–Jilin Economic Zone occupied a large number of high quality cropland in the suburbs changing the soil landscape and jeopardized food production (Li, *et al.*, 2018). Extensive development and construction in Baguio city have also led to the conversion of once thickly-forested slopes and hitherto highly absorptive substrates to impervious surfaces that define a poorly planned urbanization, resulting to a polluted environment (Gonzales, 2016).

Overreliance on own vehicles: The lack of mix of residential and non-residential (schools, offices, grocery and medical shops etc.) buildings, people in sprawls have to frequently travel to cities for daily activities. The provision of public transportation is limited; hence, use of private vehicles is inevitable. This increased use of private transport leads to several problems like traffic congestion, traffic delays, accidents, noise and air pollution, and energy wastage (Glaeser and Kahn, 2003).

The higher the sprawl, the larger the proportion of homes with at least one automobile. If an area has greater urban dispersion, the need for transportation should also be greater. Especially in a developing country, household income has an important role in this regard. More dispersed urban agglomerations have a larger proportion of automobiles, independently of income. Urban areas are increasingly complex, with fragmentation, integration and intensification of commuting. In Brazil have an important commuting element related to sprawling urbanization. These sprawling regions are transforming land use, reducing green and open spaces around cities and increasing automobile dependence, air pollution and costs of public services (Ojima, R., and Hogan, J.D., 2009). New migration flows are becoming more evident and probably will have a very marked impact on urban structures, especially in terms of access to public services by the poor. Many social problems typical of developing countries become worse with sprawl (Ojima, R., and Hogan, J.D., 2009).

Environment damages: The fragmentation of natural habitat and animal corridors by encroaching of open spaces and natural habitats at the peripheries damages the environment and causes ecological imbalance and at times may also cause extinction of species. The wetlands have been fragmented and many interconnecting water channels filled up due to excessive urban growth. The wetlands and waterways are no longer in a position to act as sponges at the times of inundation due to the vanished interconnectivity,

which they enjoyed earlier. Neither can they absorb enough water to regulate the water supply for agriculture and other domestic activities at the times of water shortage and droughts (Kuchay and Bhat, 2014). Forest and agriculture show very low levels of ecological connectivity because they have become isolated due to traditional rural abandonment, the increasing construction of transport networks and scattered urban villages. This loss of ecological connectivity through agro-forest mosaics also stresses the importance of natural corridors, like riparian zones, in maintaining the ecological processes within the landscape (Dupras, *et al.*, 2016).

Human health: Scattered distribution of houses encourages use of more own motor vehicles which restricts walking and other physical activities that have an adverse effect on individual's health causing life style diseases like obesity, diabetes, hypertension and cardiovascular problems. The study found that people living in counties marked by sprawling development are likely to walk less and weigh more than people who live in less sprawling counties. In addition, people in more sprawling counties are more likely to suffer from hypertension (high blood pressure). The study also found a direct relationship between sprawl and chronic disease. The odds of having hypertension or high blood pressure are higher for every increase in the degree of sprawl. People in sprawling areas walk less for exercise, which may help explain the higher obesity levels. People in sprawling areas may be missing out on significant health benefits that are available simply by walking, biking, climbing stairs and getting physical activity as part of everyday life (McCann and Reid Ewing, 2003).

In Australia, obesogenic environments discourage physical activity and encourage over consumption of food. There is strong evidence that the built environment affects the transport mode choices of both adults and children. A growing body of evidence confirms that neighbourhoods characterized by low-density, poorly connected street networks and poor access to shops and services are associated with low levels of walking. Moreover, urban sprawl or low walkability appears to be associated with obesity. This may be partly due to long commuter trips to reach suburbs located on the urban fringe (Giles-Corti, 2006; Garden and Jalaludin, 2009). Another potential impact of urban form on public health relates to sense of community and mental health. This has sparked interest in the impact of the urban form on mental health, particularly through its impact on the development of social capital or sense of community. Social capital is the features of social life (networks, norms and social trust) that enable participants to effectively pursue joint objectives and cooperation for mutual benefit (Giles-Corti, 2006; Garden and Jalaludin, 2009). Access to large, attractive public open space increases the odds of higher levels of walking but is said to be restorative, reducing mental fatigue and improving well being. Reduced local walking, affects opportunities for casual interactions between neighborhoods. Access to convivial neighborhoods not only encourages more walking but also encourages interactions between neighbors thereby increasing sense of community which in turn may beneficially influence positive mental and physical health in local residents (Giles-Corti, 2006; Garden and Jalaludin, 2009).

Conclusion

Urban sprawl is a multi-faceted phenomenon driven by several factors right from population growth, economic growth, unsuccessful enforcement of land use planning, extension of transportation and advancement of ICT etc. It is not so easy to declare that which factor cause sprawl as involved reasons are strongly interconnected one another and also influences each other. People of sprawl region inevitably depends upon the their own vehicle to commute for daily routine life right from going for work, shopping, schools, etc. which will generate to multiple problems relating to traffic to human health of both people of sprawl and city. Agricultural fields and biodiversity of this area are also being swallowed by encroachment of uncontrolled built up growth. The haphazard built up growth threats sustainability of region. Presently following/practicing strategies and guidelines to combat sprawl are developed by taking all factors in to consideration. Therefore, understanding and analysis of causative factors and respective impacts at individual level aid the decision makers and planners to develop an efficient mechanism to promote sustainable urbanization.

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