

Assessing lateral expansion along Delhi Meerut Expressway Corridor

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Abstract:

Over the decades, humankind have transformed the environment according to their needs and beliefs, with the globalized economy and sophisticated technology the human society have moved towards advancement so much, so the natural environment is being neglected at a huge pace. Among several such challenges one major setback can be observed within the Indian road network of the Delhi NCR region. The region between Delhi to Meerut is facing severe congestion issue resulting from increasing number vehicles on the road along with population boost and encroachment. All these factors team up to create a negative impact on the environment causing hazards such as noise pollution, fading air quality etc. Hence, to improve the road network and decrease the pollution levels the idea of an expressway between Delhi and Meerut was proposed. This study provides an insight to the development of areas around the corridors takes place. Since 1970s, the techniques of GIS and RS have emerged as an important means to analyze the land use land cover (LULC) changes. Thus, this paper also intends to examine the use of remote sensing and GIS for assessing the Spatio and temporal changes along the Delhi Meerut expressway corridor. Hence, this article is an attempt to study the LULC changes along the Delhi Meerut expressway corridor. In addition, the change detection in land use and land cover over a specified period has also been emphasized for reviewing the temporal changes occurred around this corridor. Not only this, but study also reveals the possible scope for future expansion of the expressway itself along with the areas around the expressway. Sentinel and LANDSAT data were considered for conducting the present study.

Keywords: *Corridors, Expressway, Controlled access expressways, Buffering, Change detection.*

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Introduction:

Human society is transforming this planet rapidly into the home of an intriguing system wherein an intensive usage and exhaustion of resources via anthropogenic infrastructures and complex processing systems are replacing the natural components by urban and industrial sprawling (Farina, 2007). With a population that is multiplying year on year and an infrastructure that is struggling to support it, the congesting traffic in the National Capital Region (NCR) has become the topmost concern of the state as well as central government. One of the ambitious steps taken in this direction is the Delhi-Meerut Expressway. The significance and need for an expressway between Delhi and Meerut could be judged from the fact that, the proposal to construct an expressway between Ghaziabad and Meerut was first put forward in a Lok Sabha session in the year 1999 which was later modified to a Delhi-Meerut expressway in 2005 which was projected under 'NCR Transport Plan 2021'.

With this expressway, a journey which would formerly take about 240 to 300 minutes is expected to reduce the travel time between the two cities to just 45 minutes. The main aim of building this expressway is to decongest the Delhi NCR vehicular traffic and thereby bringing down the pollution levels. Furthermore, keeping environment in mind, an eco-friendly drive has been introduced making this expressway to have the first bridge in the country as well as the world which has vertical gardens with solar power system and drip irrigation. The Delhi Meerut expressway will be a controlled access expressway having 4 major segments/phases.

Prior to Delhi Meerut expressway, the commuters had to go via NH 24 and NH 34 to travel between the two cities. The route map is depicted in the Figure 1. With most of this route having a 4-lane highway, it naturally created an insoluble dilemma for the commuters- caused due to high traffic flow and low carrying capacity of the roads.

In the present-day time, the high-speed corridors are considered as one of the most change-influencing feature for a city. The changes in the transport systems 'induce' land use changes and growth (Cervero, 2003a; Pushkarev et al., 1982).

Thus, the Spatio- temporal analysis of the Delhi Meerut expressway is of utmost importance especially when done with remote sensing and GIS techniques, as these techniques helps one to get a holistic view which can help with more efficient planning and management. Different aspects related to the expressways such as the surrounding LULC, its dimensions, the geology, topography etc. could also be studied efficiently using these techniques. The use of remote sensing for Land Use Land Cover (LULC) mapping can be dated back to 1970s and since then this technique has emerged as an important tool for this field. GIS can save time and money; we can analyze a lot just by staying at a place.

So, through this paper we intend to quest the thirst about some simple yet powerful scenarios i.e. what are the spatial and temporal changes that have taken place with the construction of the Delhi Meerut expressway corridor and what could be the possible changes that could take place soon? This question is multi-dimensional it includes several other questions like, what are the Land-use and Land-cover (LULC) changes that can be witnessed around this expressway, what is the approx. zone of influence of this expressway? What are the major and minor cities that are connected via Delhi Meerut expressway corridor? Etc.

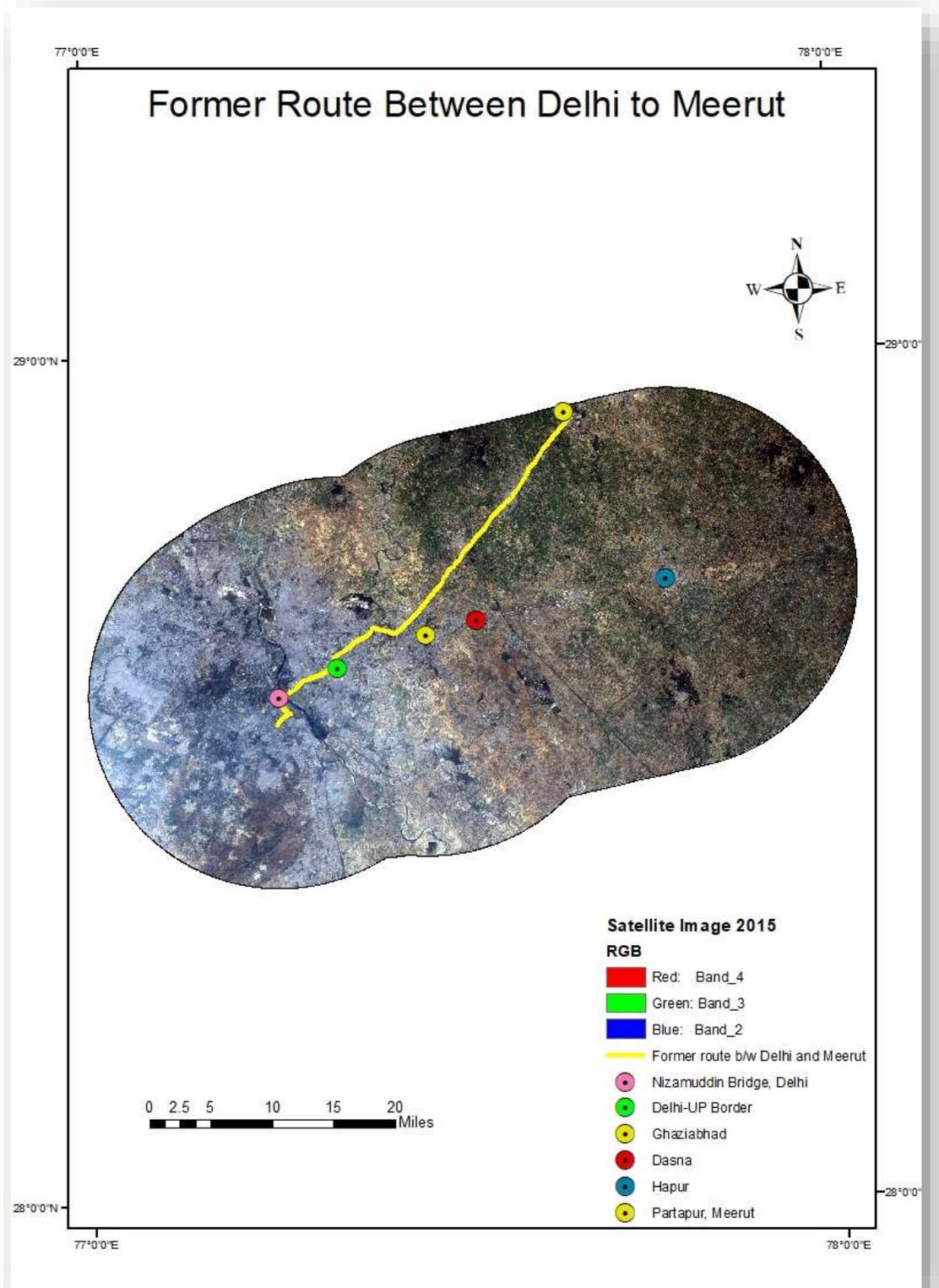


Figure 1: Former route between Delhi to Meerut- Satellite Imagery LANDSAT8 (2015)

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The work had the following objectives to be achieved:

1. To trace prominent nodal junctions along the Delhi Meerut expressway corridor.
2. To evaluate the lateral expansion along Delhi Meerut expressway corridor.
3. To estimate the amount of urbanization along buffer areas of Delhi Meerut expressway.
4. To suggest the measure for future expansion and development of the nodal points.

Conceptual Basic

Talking about the Indian road network one can say that the expressways are one of the highest classes of roads. The expressways are built to make travelling easy. Controlled access expressways are a type of expressway which has been planned for high-speed vehicular traffic, with all traffic flow & ingress/egress regulated. Such type of expressways has no traffic lights or crossings; however, it does include foot-over bridges and underground passes. In general, a transport corridor is a linear area which has one or more modes of transportation like highways, railroads or public transit sharing common course. Development often takes place around transportation. In the present journal the term corridor has being linked only to highways (expressways).

Study Area

Spread across a state and a union territory, the study area i.e. the Delhi Meerut Expressway is India's widest expressway connecting Delhi to Meerut via Dasna. It has got a length of about 96kms. Geographically, the study area is spread across 1 union territory and 2 districts of UP. It goes from approx. 28°35' N - 77°15' E (Nizamuddin Bridge, Delhi) to 28°55' N – 77°38' E (Partapur, Meerut). The first 3 phases of the expressway are mainly on NH24 (Figure 2).

This is a controlled access expressway which is divided into 4 segments. The first phase connects Nizamuddin Bridge to Delhi-UP Gate, the second phase will link Delhi-UP Gate to Dasna while the third phase will join Dasna to Hapur and finally the fourth phase, which will be a completely new alignment will connect Dasna to Meerut bypass at Partapur. Interestingly it is also the very first expressway to dedicate bicycle tracks on approx. 28 km stretch joining Nizamuddin Bridge to Dasna. Another fact making it unique is that, the NHAI (National Highway Authority of India) plans to utilize the solid waste of Ghazipur landfill in the construction of Delhi-Meerut highway to curb the pollution.

The first two segments of the expressway will have 14 lanes (thereby making it India's widest expressway) while the third and the fourth segment will have 8 and 6 lanes respectively. The first phase is 8.7 km long; it has the shortest length among all the 4 phases. The 14 Lane is 6 Lane Expressway, 8 Lane Normal Highway and 2.5 m Bicycle Tracks which will be on Both Sides. Notably this phase was recently inaugurated on 27th May 2018 by PM Narendra Modi. As of June 2018, this is the only phase which is completed. The second phase will be 19.2 km long; it will also be a 14-lane expressway which will have 15 underpasses and one flyover. Talking about the third phase, it will be 22.2km long and will have 8 lanes. Whereas, the last phase i.e. the fourth phase will be the longest segment of this expressway which will have 6 lanes. It will be a completely new alignment because, of the decision of Rapid Rail Transit System (RRTS) to use the dividers on NH-58 for trains' elevated corridor.

According to R.P Singh, project director at NHAI, the construction work of the Delhi-Meerut expressway for the 3rd segment (which began in March 2017) has about 60% of its work completed, as of May 2018 and on the other hand, the 4th phase which is entirely Greenfield, is only 3% completed with the land

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acquisition still a creating hurdle. According to Mr. Singh, “There are some small pockets where land acquisition is yet to be completed in phase 4” and as a result it is still uncertain as to when will the construction of phase 4 begin.

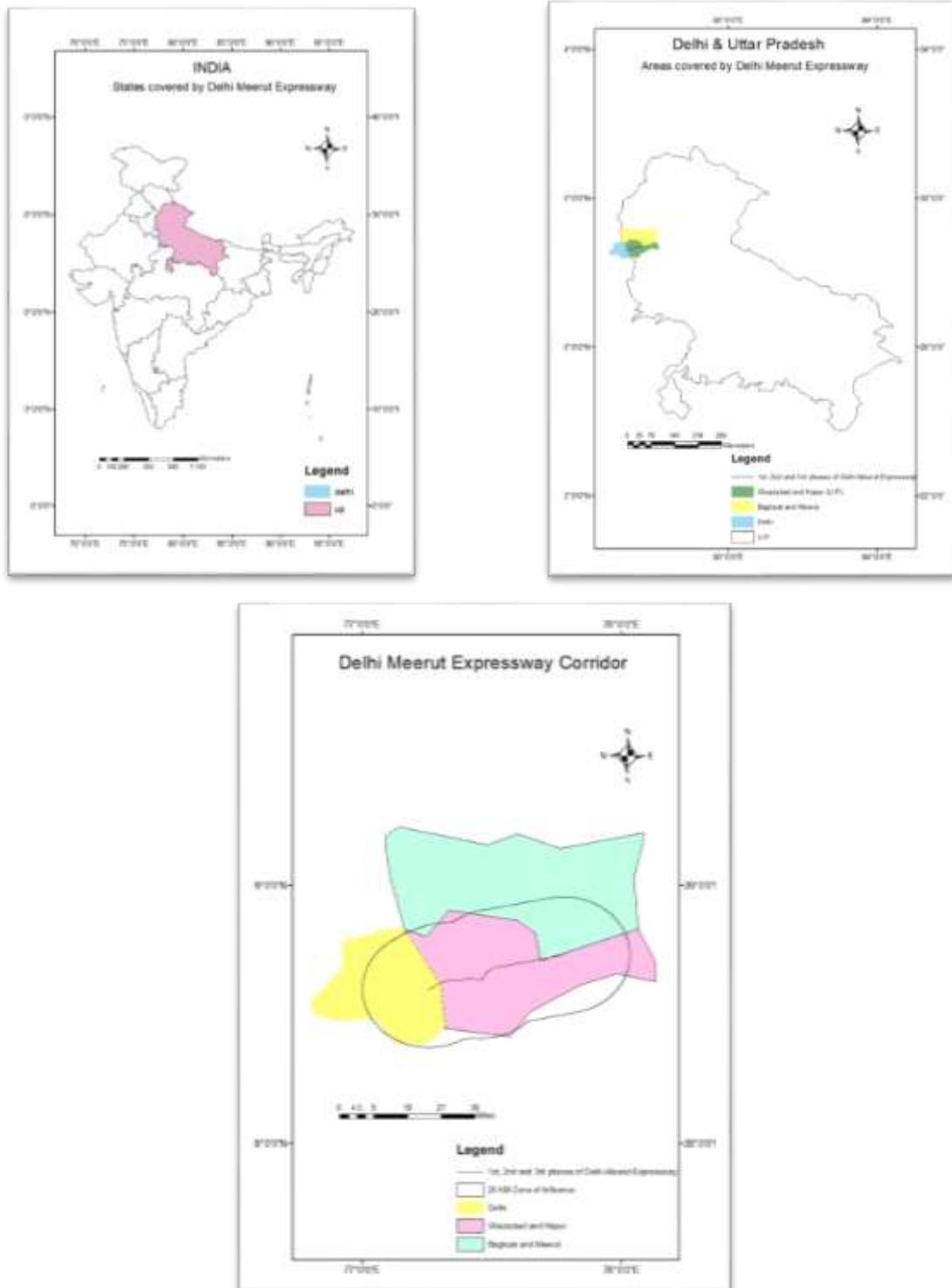


Figure 2: Location of Study Area

Methodology:

Data Used

A moderately detailed land cover map was required for the study, so data retrieved from Sentinel 2B was brought to use.

Table 1 :Specification of Sentinel 2B

Number of Bands	13
Spatial Resolution	10m, 20m and 60m
Field of View	290kms
Instrument	MSI- Multi Spectral Instrument
Revisit (Days)	5- under same viewing angles

Table 2: Specification of Sentinel 2B data

Specifications	Years	
	2018	2017
Date of acquisition	2018.06.19	2017.03.21
Platform	Sentinel 2B	Sentinel 2B
Orbit	105	105
Datum	WGS84	WGS84
UTM Zone	43	43

Table 3:Specification of LANDSAT 8 data 2015

Date of acquisition	2015.11.11
Map Projection	UTM
Datum	WGS84
UTM Zone	43

Software Used

he current used various geostatistical and mapping tools from ArcGIS Desktops software for making land use and landcover maps to visualise the extend and to vectorise the spread of the metro network in Delhi. Various additional tools like buffer and extract tools from ArcGIS Desktop were used for making buffer and layers.

Steps followed

The main objective of this research lies with analyzing the fragmentation of the land cover and so land cover is a primary dataset in this study. Present maps were prepared using the satellite imageries with the help of visual and digital interpretation techniques. Figure 3 presents a flow chart of the methodology that schematically represents the entire process. Cloud free data was preferred for avoiding any geometric corrections. The data sets needed for a single year were all acquired of the same day to avoid any kind of distortion. Once acquired it was then stacked and mosaicked for further processing (using Arc GIS).

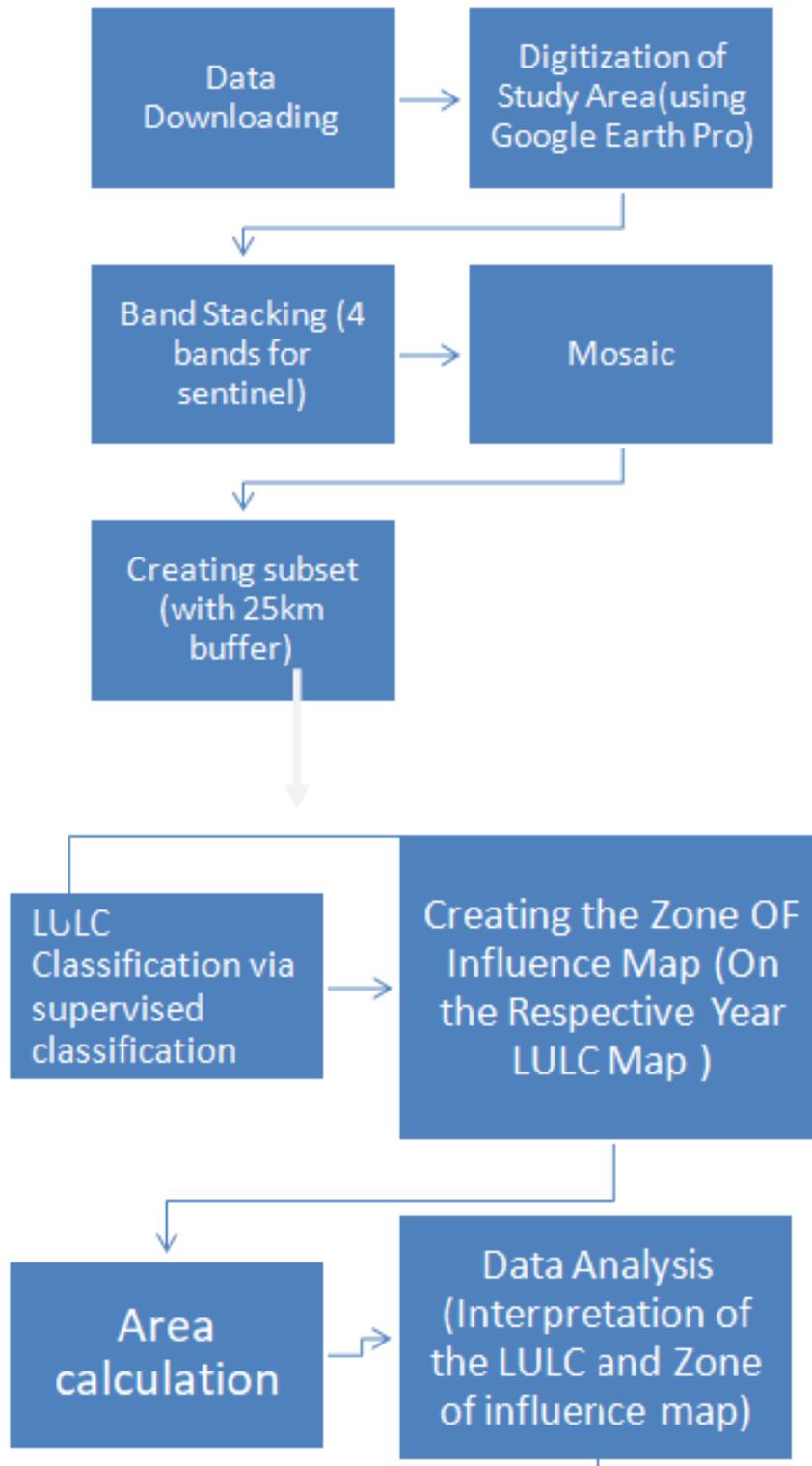


Figure 3: Flowchart of the Comprehensive Methodology

Data Analysis

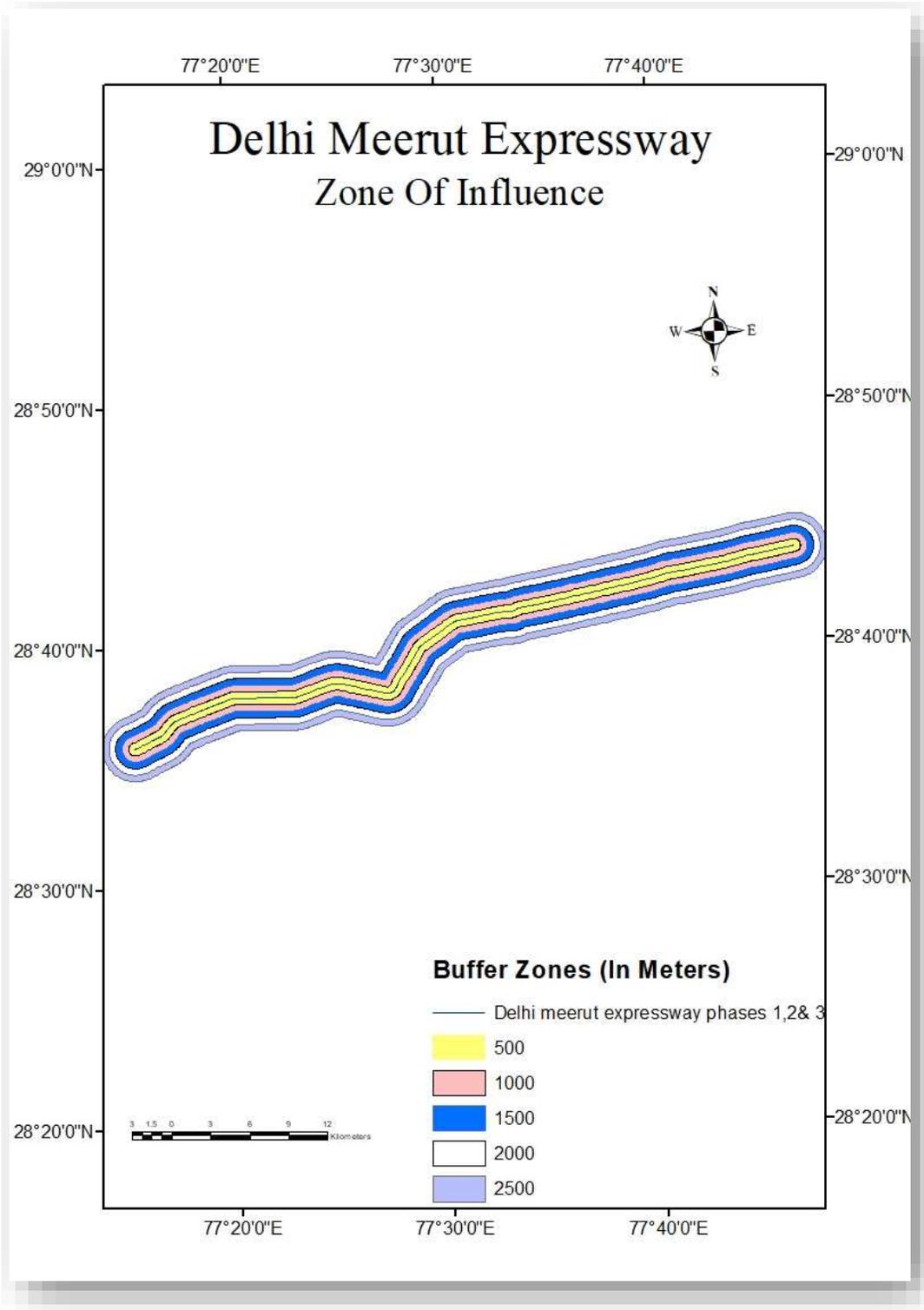


Figure 4: Various Lateral Zone of Influence (in Meters)

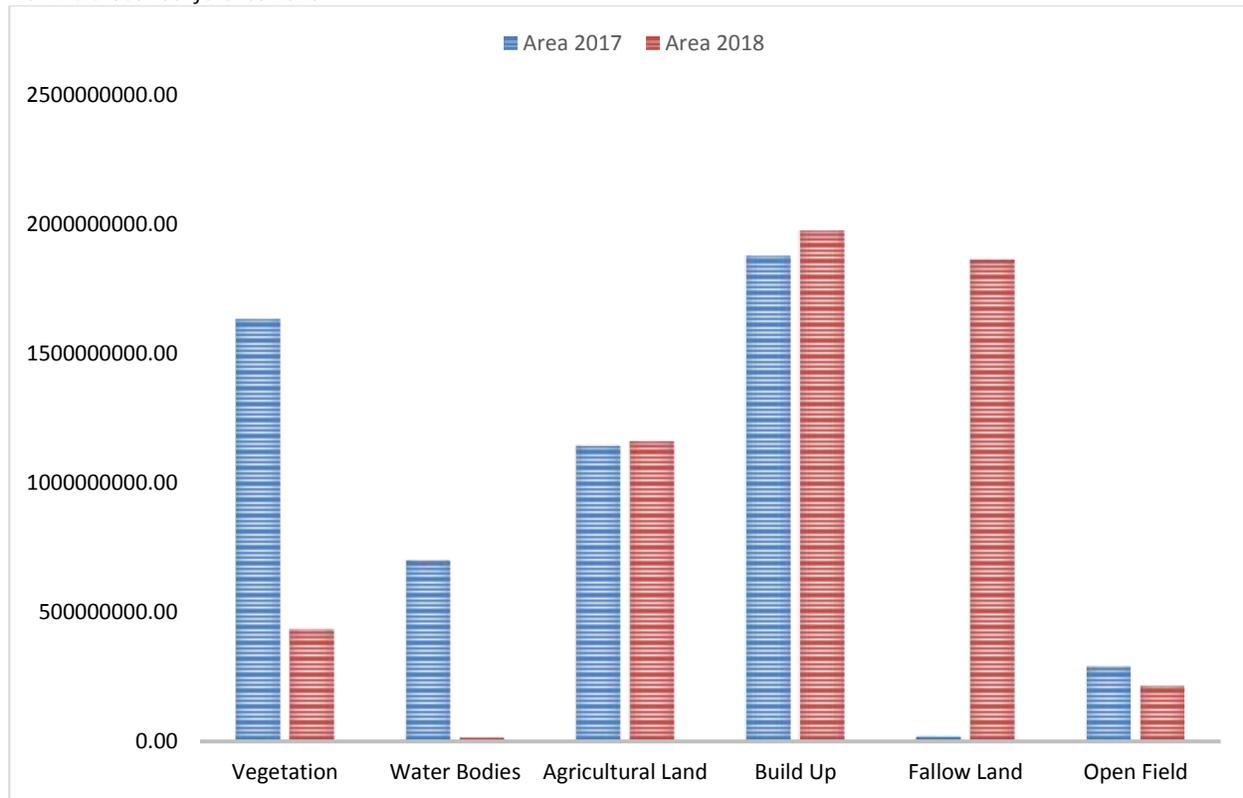


Figure 5: Comparative Analysis of Land Use Land Cover Area (in m²) during 2017 and 2018

The combined analysis along the Delhi Meerut Expressway Corridor done with different buffer zones as depicted in Map 3, highlights (as seen in figure 2), the built up area has shot up over the duration of time which could be because of immigration taking place due to the better conveyance provided by the Delhi Meerut Expressway corridor and also because of colonization in NCR for its proximity to the national capital. As a result, an upsurge in the population and built up land can be clearly noted. With increasing population, the demand for natural resources (such as, land, water etc.) are naturally rising, eventually resulting in dramatically dropping water levels along with open fields and vegetation (which could probably be due to construction activities). Moreover, slight increase is well noticeable in the agricultural land's area. Another feature i.e. fallow land can said to be awfully spreading which could possibly be a result of the constant constructions and the declining fresh water availability in the region. Following are the two LULC maps satellite imageries which present a geographical perspective to the information discussed above.

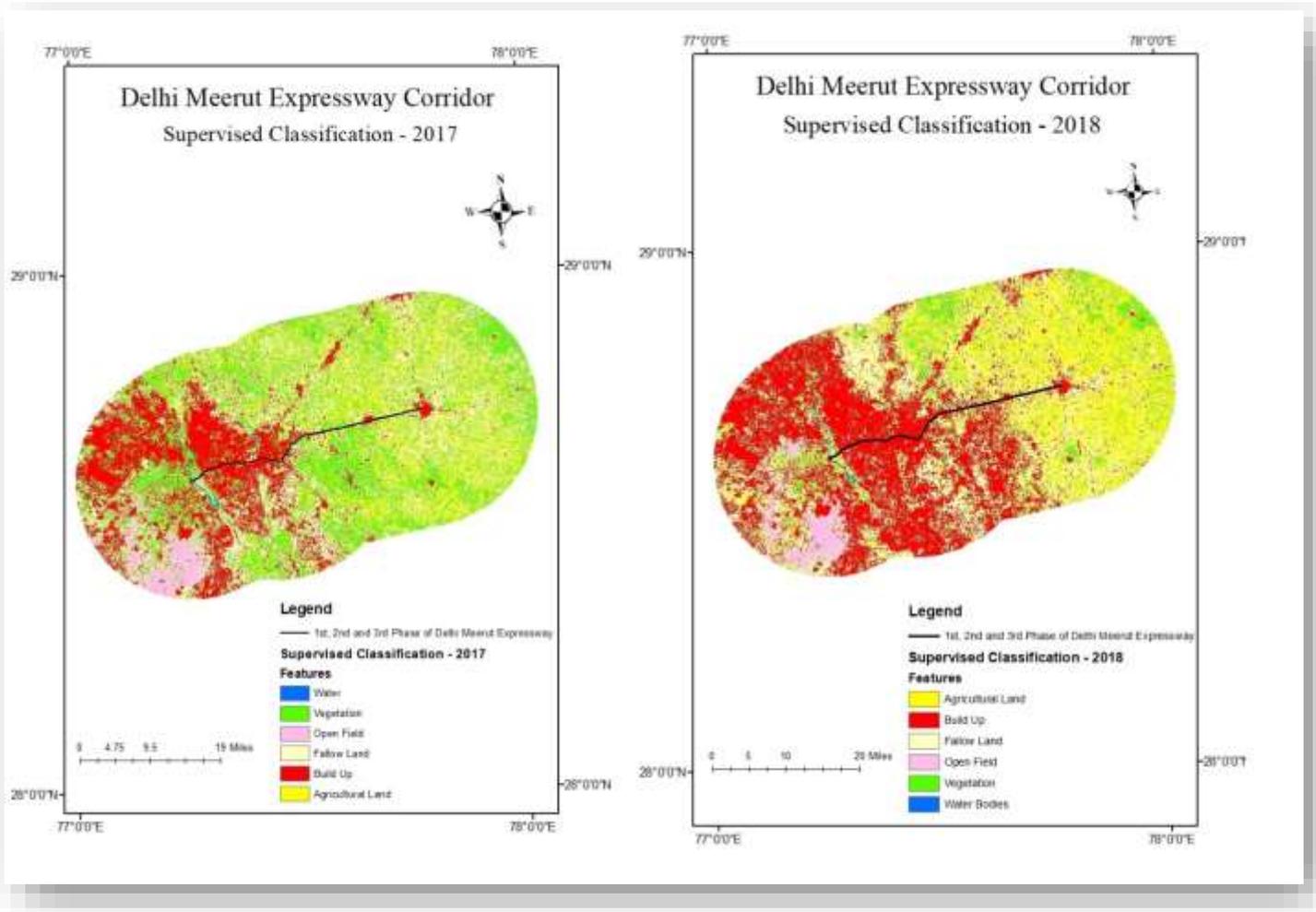


Figure 6: Land Use Land Cover Map for the Year 2017 and 2018

Conclusion:

The major observation obtained through this journal is that, from the year 2017 to 2018 there has been a high increase in the amount of urbanization around the expressway corridor. There could be several factors for the same namely, immigration, conveyance, etc. This increase in the build-up region has a direct negative impact on the fresh water availability of a region, the two categories have a negative correlation i.e. if build up land increases, then the demand for water will naturally increase, thereby resulting in the decline fresh water availability in the region and vice versa. Additionally, it was also observed that the amount of fallow land has dramatically increased from the year 2017 to 2018 which can possibly be the result of land clearance for different construction activities. Altogether, a clear change of LULC can be clearly perceived between the features of the two regions can be observed and thus we can say that the Delhi Meerut Expressway corridor has a middling impact on the LULC changes in the region. Infrastructural development for any region is a positive mark but it should never be the central theme of developmental process because then the environment will severely be affected. Thus, there must be sustainable

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development, a balance needs to be created between the two subject matters and they should move parallel to each other. In a world where people are planning to live on Mars and space agencies like NASA is launching missions to 'TOUCH' the sun, the society is in a tearing rush, and somehow the so called 'development' which is said to be helping people lead better lives ends up negatively impacting the environment thus reversing the expected consequences.

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