

Impact of Urbanization on Land Use Pattern of Rural-Urban Gradient of Bengaluru North: An Economic Analysis

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ABSTRACT

Pressure on farm land is increasing at the periphery of the cities and the developmental pressures led by the urbanization process transforming farm lands into non-agricultural landscapes which is irreversible. Hence the study was conducted along rural-urban continuum of Bengaluru North to analyze the impact of urbanization on land use pattern and production systems. The results of the study revealed that the area under non-agricultural uses is growing significantly with positive trend in the Bengaluru urban and Bengaluru rural districts and Bengaluru North and Devanahalli taluks where the influence of Bengaluru sprawl is more and in rural gradient its growth is insignificant. The net sown area has recorded significant negative growth in urban gradient and is insignificant in other two gradients. The correlation between area under non-agricultural uses and net sown area was significant and strongly negatively correlated in urban gradient. The extent of their correlation co-efficient decreases as the urban influences decreases. Field crops have seen devastation in the last decade at urban and peri-urban gradients. Because of ground water shortage and frequent failure of bore wells, the area under vegetable crops and mulberry has reduced at farm level, where as the area of fruit crops under micro irrigation system has increased. Hence in the view of rapid growth of Bengaluru city, there is a need for measures to control irreversible damage of farm lands and agrarian community in the area.

Keywords: Urbanization, area under non-agricultural uses, net sown area, correlation, production systems, agrarian community

The process of urbanization is characterized by a gradual increase in the proportion of people living in urban areas, typically through rural-urban migration or expansion of urban fringes into rural areas. Urbanization is a global phenomenon which comes with human settlements and accompanying anthropogenic activities and it plays an important role in the land use and land cover change (Jagadeesh *et al.*, 2015). The urban sprawl is one of the most noticeable effects of urbanization on land use (Bhagwat Rimal, 2014). The phenomenon has led to gradual change of rural landscape to urban landscape, where in land use systems like agricultural land, barren, fallow, forest, pastures and grazing lands were turned into built-up and non-agricultural uses. Delhi being one of the rapidly growing city of India has seen reduction in the forest

land, permanent pasture, net area sown, cultivable wasteland and fallow land by 28.30, 91.82, 16.09, 9.10 and 14.53% respectively from 1990-91 to 1996-97, whereas non-agricultural land was increased by 11.42% (Lintelo *et al.*, 2001).

There is a negative correlation between area under non-agricultural uses and net sown area but extent of negative association increases with increase in urban influences indicating the more pronounced use of agricultural area for non-agricultural uses in high urban influence areas. Urban influences results in the growth of the area put to non-agricultural uses over the period. Li jiang *et al.* (2013) opines that the urban expansion is associated with decline in agricultural land use intensity in China and similar results were reported by Eyaya (2014). Seema (2014) also reports that as a result of urban expansion,

land use/land cover has changed drastically at the periphery of the Jalandhar city and it has led to the transformation of the rural landscape into the urban landscape where in built up area has increased to 37% (2010) from 8% (1975) at the cost of reduction in farm land from 52% to 31%.

Apart from land use changes between agriculture and non-agricultural uses, the process of urbanization brings changes within agriculture also by way of reduction in area under field and traditional crops or increase in area under commercial crops as induced by urban demands. Goswami and Challa (2004) observed changes in the cropping pattern of India for the period 1950-51 to 1997-98 and inferred the proportion of area under cereals to total cropped area had decreased from 61.1% to 53.8% which was attributed to conversion of land for non-agricultural uses led by pressures of urbanization, industrialization, and demand for land for housing.

Bengaluru city is known for its dynamicity and is one of the fastest growing cities in the world. The urbanization process has resulted in transition in land use, land values, water resources, lifestyles and livelihood options around the Bengaluru and is more pronounced towards Bengaluru north because of developments viz., International airport, National highways, Hardware Park, Financial city project and other industries. Hence the study was focused on the land use pattern in Bengaluru North as this region has attracted lot of activities as growth in southern part of the is reaching the saturation point.

Data base and Methodology

A multistage random sampling procedure was employed for the selection of study area and sample respondents. At the first level Bengaluru Urban (Urban), Bengaluru Rural (Peri-Urban) and Chikkaballapur (Rural) districts were selected and in next level Bengaluru North, Devanahalli and Gudibande taluks were selected and in each taluk four villages were selected at random. In the next and last level 15 sample farmers were randomly selected from each village thus forming a total sample size of 180 with equal spread of 60 from each gradient.

The study makes use of both primary and secondary data for better comprehension of the impact of urbanization process on land use system and production systems. So in order to know the

changes happened within agriculture in the last decade, information on the area under different production systems during 2005-06 and 2015-16 was collected from the sample respondents by recall. The current status of leasing of farm land for activity for agricultural and non-agricultural uses was also collected by using a pre-tested schedule through personal interview method. Secondary data on land use pattern in the district as well as on taluk was collected for the period 2000-01 to 2015-16 from Directorate of Economics and Statistics, Bengaluru. Since the Chikkaballapura district was separated from Kolar district during 2007-08, results were given separately as Kolar and Chikkaballapura and similarly in Bengaluru rural district also four taluks were separated and formed a new district. Hence results are presented under two separate headings as before and after. Analytical measures like descriptive measures, percentage changes were used in analyzing the change in area under different land use systems. Graphical representations were made to see the share of different land use systems in different periods.

Compound Growth Rate Analysis

In order to assess the growth in area under different land use systems during 2000-01 to 2015-16 across different gradients both at district and taluk level, compound growth rates were estimated using the exponential function of the form:

$$Y_t = ab^t u_t \quad \dots(1)$$

Where,

Y_t : Dependent variable for which growth rate was estimated (area)

a : Intercept (constant)

b : Regression coefficient

t : Years which take values, 1, 2, ...,n

u_t : Disturbance term for the year t

The equation (1) was transformed into log linear form for estimation purpose and was estimated using Ordinary Least Square (OLS) technique. The compound growth rate (g) in percentage was computed from the relationship,

$$g = (\text{Antilog} (\ln b) - 1) * 100.$$

The significance of the regression coefficient was tested by using the 't' test.

Correlation analysis

In studying the relationship between land put to non-agricultural uses and net sown area, a scatter plot was constructed using the data for the period 2000-01 to 2015-16 with the aim of determining the nature of the relationship. Scatter plots revealed a negative linear relationship between the variables among all cases except Chikaballapura district, where positive linear relationship was recorded. Correlation coefficient was estimated using the Pearson's Product Moment Correlation Coefficient formula as given below,

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n(\Sigma x^2) - (\Sigma x)^2][n(\Sigma y^2) - (\Sigma y)^2]}}$$

Where,

- r = correlation coefficient
- x = land put to non-agricultural uses,
- y = net sown area
- n = the number of data pairs.

The significance of the relationship was tested by using the formula given below with degrees of freedom equal to n - 2. (Mendehhall *et al.*, 1989; Oakshott, 2006)

$$t = r\sqrt{n-2} / \sqrt{1-r^2}$$

Where,

- r = correlation coefficient
- n = number of observations
- t = test statistic

RESULTS AND DISCUSSION

Influence of urbanization on land use systems using taluk and district level data

At the taluk level in urban and peri-urban gradients the area under non-agricultural uses was growing significantly at the rate of 2.22% and 3.47 respectively. The peri-urban gradient experienced higher growth in the area under non-agricultural uses, due to

pronounced farm land sales attracted by surged prices led by developments like international airport and six lane national highways in the last decade. The share of area under non-agricultural uses in total geographical area has increased from 42 to 56% in urban and from 13 to 22% in peri-urban gradient during 2001-02 to 2015-16. The net sown area (-3.68 %) in the urban gradient had recorded significant negative growth and its share in total geographical area was halved during the study period indicating the higher rate of conversion of agricultural area to non-agricultural uses because of high urban pressure. The growth in net sown area in peri-urban and area under non-agricultural uses as well net sown area in rural gradient were insignificant (Table 1).

At district level, in urban gradient the share of area under non-agricultural uses in the total geographical area had increased from 42 to 57% in the reference period with growth rate of 2.4% annually which is significant. The share of net sown area had decreased from 38 to 17% with a negative growth rate of 4.84% annually and was significant. Area under miscellaneous tree crops and grooves, barren and suitable for agriculture has seen significant negative growth, whereas area under barren and not-suitable for agriculture and Other than current fallow land has seen significant positive growth. In peri-urban gradient the area under non-agricultural uses has grown significantly with a growth rate of 2.79 and 1.36% during 2001-02 to 2006-07 and 2007-08 to 2015-16 respectively. Area under miscellaneous tree crops and grooves, barren and both suitable as well not-suitable for agriculture and permanent pastures and other grazing land had registered negative growth in the first reference period (Table 2). In rural gradient only area under barren and suitable for agriculture was significant in the second reference period with a negative annual growth rate of 4.21%. The insignificant growth of area under non-agricultural uses and net sown area in rural gradient indicates negligible influence of urbanization (Table 3).

Area under non-agricultural uses has undergone significant positive growth in Bengaluru urban and Bengaluru rural in general and Bengaluru North and Devanahalli in particular and this could be attributed to high urban influences. However the net sown area experienced significant negative growth

Table 1: Land use pattern at taluk level across the three gradients (Hectares)

Sl. No.	Land use	Urban (Bengaluru North)			Peri-Urban (Devanahalli)			Rural (Gudibande)				
		2001-02	2015-16	% Δ	2001-02	2015-16	% Δ	2001-02	2015-16	% Δ	CAGR (%)	
1	Non-agricultural uses	32644 (42)	44315 (56)	35.75 (10.98)	5730 (13)	9788 (22)	70.82 (5.43)	2270 (11)	2272 (10)	0.09 (1.77)	3.47* (5.43)	0.11 ^{NS} (1.77)
2	Net sown area	26676 (34)	12812 (16)	-51.97 (-4.57)	27545 (61)	22085 (49)	-19.82 (-1.37)	14309 (66)	14507 (67)	1.38 (1.21)	-0.98 ^{NS} (-1.37)	1.15 ^{NS} (1.21)
3	Current fallow land	9047 (12)	10282 (13)	13.65 (-1.29)	392 (1)	2758 (6)	603.57 (1.22)	156 (1)	119 (1)	-23.72 (-1.15)	5 ^{NS} (1.22)	-11.7 ^{NS} (-1.15)
4	Miscellaneous tree crops and grooves	3429 (4)	3589 (5)	4.67 (-0.3)	4640 (10)	3354 (8)	-27.72 (-4.04)	294 (1)	294 (1)	0.00 (0)	-2.30* (-4.04)	0 (0)
5	Barren and not-suitable for agriculture	2013 (3)	1994 (3)	-0.94 (-4.8)	1477 (3)	1477 (3)	0.00 (0)	1268 (6)	1268 (6)	0.00 (0)	0 (0)	0 (0)
6	Barren and suitable for agriculture	1306 (2)	1203 (2)	-7.89 (-1.62)	1592 (4)	1442 (3)	-9.42 (-4.31)	310 (2)	150 (1)	-51.61 (-5.13)	-0.77* (-4.31)	-6.27* (-5.13)
7	Permanent pastures and other grazing land	1156 (1)	1197 (2)	3.55 (2.6)	912 (2)	673 (2)	-26.21 (-4.37)	490 (1)	230 (1)	-53.06 (-5.13)	-2.22* (-4.37)	-6.52* (-5.13)
8	Area under forest	1145 (1)	1145 (1)	0.00 (0)	2275 (5)	2275 (5)	0.00 (0)	2534 (12)	2534 (12)	0.00 (0)	0 (0)	0 (0)
9	Other than current fallow land	990 (1)	1874 (2)	89.29 (1.09)	372 (1)	1083 (2)	191.13 (2.04)	14 (0.01)	271 (1)	1835.71 (2.72)	10.58 ^{NS} (2.04)	25.42** (2.72)
Total geographical area		78411	78411		44935	44935		21645	21645			

Note: Figures in the parenthesis are percentage to the total geographical area, % Δ= Percentage change

*=Significant at 1%, **=Significant at 1% and NS= Non-significant

Table 2: Land use pattern at district level in urban and peri-urban gradient (Hectares)

Sl No	Land use	Urban (Bengaluru Urban)			Peri-Urban (Bengaluru Rural I)			Peri-Urban (Bengaluru Rural II)					
		2001-02	2015-16	% Δ	CAGR (%)	2001-02	2006-07	% Δ	CAGR (%)	2007-08	2015-16	% Δ	CAGR (%)
1	Non-agricultural uses	91776 (42)	124791 (57)	35.97	2.4* (12.16)	58084 (10)	65616 (11)	12.97	2.79* (4.99)	39978 (17)	45468 (20)	13.73	1.36** (2.9)
2	Net sown area	81833 (38)	37148 (17)	-54.61	-4.84* (-10.75)	295042 (50)	242987 (41)	-17.64	-1.21 ^{NS} (-0.43)	123753 (54)	112214 (49)	-9.32	-0.47 ^{NS} (-0.49)
3	Current fallow land	15656 (7)	21564 (10)	37.74	0.91 ^{NS} (0.76)	36772 (6)	63309 (11)	72.17	-0.11 ^{NS} (-0.01)	11593 (5)	15711 (7)	35.52	-1.06 ^{NS} (-0.22)
4	Miscellaneous tree crops and grooves	7617 (4)	7648 (4)	0.41	-1.62** (-2.58)	21845 (4)	16177 (3)	-25.95	-8.1** (-3.89)	12227 (5)	13429 (6)	9.83	1.61* (5.5)
5	Barren and not-suitable for agriculture	4885 (2)	4911 (2)	0.53	0.03** (2.68)	35663 (6)	35463 (6)	-0.56	-0.12** (-2.95)	11124 (5)	11124 (5)	0.00	0
6	Barren and suitable for agriculture	4338 (2)	3889 (2)	-10.35	-1.57* (-2.98)	5806 (1)	5076 (1)	-12.57	-3.02** (-2.64)	3898 (2)	3898 (2)	0.00	0
7	Permanent pastures and other grazing land	5175 (2)	5674 (3)	9.64	-0.03 ^{NS} (-0.15)	30623 (5)	28541 (5)	-6.80	-1.47** (-4.39)	3879 (2)	3879 (1)	0.00	0
8	Area under forest	3303 (2)	5055 (2)	53.04	0	81268 (14)	81268 (14)	0.00	0	11322 (5)	11322 (5)	0.00	0
9	Other than current fallow land	2827 (1)	6730 (3)	138.06	5.2* (7.18)	20328 (4)	46994 (8)	131.18	6.99 ^{NS} (0.41)	11745 (5)	12474 (5)	6.21	2.25 ^{NS} (1.14)
	Total geographical area	217410	217410			585431	585431			229519	229519		

Note: Figures in the parenthesis are percentage to the total geographical area, % Δ= Percentage change
 *=Significant at 1%, **=Significant at 1% and NS= Non-significant

Table 3: Land use pattern at district level in rural gradient (Hectares)

Sl. No.	Land Use	Rural (Kolar)			Rural (Chikkaballapura)				
		2001-02	2006-07	% Δ	2007-08	2015-16	% Δ	CAGR (%)	
1	Net sown area	350559 (45)	287237 (37)	-18.06	170699 (42)	193250 (48)	13.21	-0.12 ^{NS} (-0.03)	1.22 ^{NS} (1.08)
2	Land put to non-agricultural uses	73935 (9)	77610 (10)	4.97	31933 (8)	32743 (8)	2.54	0.69 ^{NS} (1.74)	0.16 ^{NS} (1.73)
3	Area under forest	70324 (9)	70324 (9)	0.00	49704 (12)	49704 (12)	0.00	0	0
4	Barren and not-suitable for agriculture	63172 (8)	63172 (8)	0.00	34302 (8)	34302 (8)	0.00	0	0
5	Barren and suitable for agriculture	12540 (2)	12540 (1)	0.00	6143 (2)	4743 (1)	-22.79	0	-4.21* (-4.58)
6	Permanent pastures and other grazing land	98928 (13)	98928 (13)	0.00	59510 (15)	55550 (14)	-6.65	0	0
7	Miscellaneous tree crops and grooves	13491 (2)	13491 (2)	0.00	6482 (2)	6482 (2)	0.00	0	0
8	Current fallow land	87115 (11)	134649 (17)	54.56	37025 (9)	14579 (4)	-60.62	-0.89 ^{NS} (-0.09)	-11.69 ^{NS} (-1.85)
9	Other than current fallow land	9403 (1)	21516 (3)	128.82	8703 (2)	13148 (3)	51.07	10.34 ^{NS} (1.49)	10.26 ^{NS} (1.8)
Total		779467	779467		404501	404501			

Note: Figures in the parenthesis are percentage to the total geographical area, % Δ= Percentage change, * = Significant at 1%, ** = Significant at 1% and NS = Non-significant

Table 4: Production system wise land use among respondents in two periods across the gradients (Hectares)

Sl. No.	Area under different groups	Gradient-I (Urban)			Gradient-II (Peri Urban)			Gradient-III (Rural)		
		2005-06	2015-16	% Δ	2005-06	2015-16	% Δ	2005-06	2015-16	% Δ
1	Field crops	34.05 (45)	16.92 (29)	-50.31	45.42 (53)	33.70 (46)	-25.79	62.96 (50)	64.68 (54)	2.73
2	Vegetable crops	11.34 (15)	9.66 (17)	-14.79	10.73 (12)	9.48 (13)	-11.64	45.63 (36)	40.35 (34)	-11.57
3	Fruit crops	15.20 (20)	16.64 (29)	9.49	10.63 (12)	10.85 (15)	2.07	1.94 (2)	6.37 (5)	227.79
4	Flower crops	7.89 (10)	4.60 (8)	-41.73	2.62 (3)	4.86 (7)	85.50	0.61 (1)	1.30 (1)	113.33
5	Mulberry crop	2.63 (3)	0.20 (0)	-92.31	4.45 (5)	1.21 (2)	-72.73	11.13 (9)	1.85 (2)	-83.38
6	Forest Species	2.43 (3)	3.62 (6)	49.02	7.38 (9)	3.84 (5)	-47.97	0.49 (0)	1.11 (1)	128.48
7	Fallow land	2.98 (4)	6.60 (11)	121.33	5.06 (6)	9.14 (12)	80.61	2.43 (2)	3.64 (3)	50.00
Total		76.52	58.24	-23.89	86.29	73.09	-15.30	125.18	119.30	-4.70

Note: Figures in the parenthesis are percentage to the total, % Δ = Percentage change

in Bengaluru urban in general and Bengaluru North in particular because of very high urban influence. Similar results were reported by Te lintelo *et al.* (2001) in the context of Delhi, where net area sown decreased by 16.09% and non-agricultural land increased by 11.42% during 1990-91 and 1996-97 and Bhagawat (2013) in the context of Pokhara sub-metropolitan city of Nepal where urban area coverage increased to 51.42% from 6.33% and cultivated land decreased to 20.27% from 60.73% during 1977 to 2010. Seema (2014) and Kavitha *et al.* (2015) also presented similar results in their studies conducted around Jalandhar and Bengaluru cities.

Influence of urbanization on production systems

In the last decade the process of urbanization evidenced so many changes within agriculture also in the form of change in production systems apart from conversion of farm land for non-agricultural uses. Based on the urban demands and the resource constraints the production systems tend to change in the surroundings of the cities. Hence the area under different production systems during two periods was collected from sample respondents and results of analysis are summarized in table 4. In urban and peri-urban gradients where urban influence was

high, the area under field crops had reduced to an extent of -50.31 and -25.79% respectively during 2005-06 to 2015-16, where as in rural gradient, it has recorded a marginal rise to an extent of 2.73% in the same period. However, the area under the water intensive crops, vegetables and mulberry had decreased in all the gradients because of acute shortage of irrigation water, as the ground water is depleting at a rapid rate in the study area.

This was also corroborated by the Central Ground Water Board as this region is declared as groundwater overexploited zone. Across all the gradients area under fruit crops, mainly grapes and guava has increased marginally in area. Area under flower crops, mainly rose, chrysanthemum and marigold was increasing in peri-urban and rural gradient, and decreasing in urban gradient. The extent of rise in fallow lands was relatively higher in urban area compared to the other gradients because of leasing out of agricultural land for non-agricultural uses and decrease in interest in agriculture. In peri-urban gradient, area under forest species especially eucalyptus had reduced because of sale of land for non-agricultural uses. Goswami and Challa (2004) also express the similar results in the context of urbanization and industrialization in India.

Table 5: Purpose wise leasing of land among respondents across the gradients

Sl. No.	Kind of lease	Purpose	Gradient-I (Urban)n=60			Gradient-II (Peri Urban) n=60			Gradient-III (Rural)n=60		
			No.	Extent (ha)	Benefit (Cash or Kind)	No.	Extent (ha)	Benefit (Cash or Kind)	No.	Extent (ha)	Benefit (Cash or Kind)
1	Leased in	Agriculture	6 (10.00)	8.17	₹ 7410 or 5 Quintals of Ragi	2 (3.33)	1.76	6.17 Quintals of Ragi	4 (6.66)	5.38	1/4th of the main product
		Non-Agriculture	0	0.00	—	0	0.00	—	0	0	—
		Agriculture	3 (5.00)	2.53	₹ 7410 or 5 Quintals of Ragi	1 (1.66)	0.73	6.17 Quintals of Ragi	1 (1.66)	0.80	1/4th of the main product
2	Leased out	Non-Agriculture	4 (6.66)	3.44	₹ 12350	1 (1.66)	0.30	₹ 7410	0	0	—
		Agriculture	9 (15.00)	10.70	₹ 7410 or 5 Quintals of Ragi	3 (5.00)	2.49	6.17 Quintals of Ragi	5 (8.33)	6.18	1/4th of the main product
Non-Agriculture		4 (6.66)	3.44	₹ 12350	1 (1.66)	0.30	₹ 7410/-	0	0	—	

Note: Figures in the parenthesis are percentage to the total

Table 6: Correlation between area under non-agricultural uses and net sown area at district and taluk level across the gradients

Sl. No	Gradient	District/Taluk	Correlation Co-efficient
1	Urban	Bengaluru Urban	-0.96* (-12.34)
		Bengaluru North	-0.78* (-4.63)
		Bengaluru Rural I	-0.27 ^{NS} (-0.61)
2	Peri-Urban	Bengaluru Rural II	-0.48 ^{NS} (-1.45)
		Devanahalli	-0.56** (-2.51)
3	Rural	Kolar	-0.51 ^{NS} (-1.33)
		Chikkaballapura	0.20 ^{NS} (0.54)
		Gudibande	-0.05 ^{NS} (-0.19)

Note: * significant at 1%, ** significant at 5% and NS=Non-significant

Status of leasing of farm land across the gradients

Leasing of farm land for agriculture as well non-agricultural purposes was common process across the gradients. It can be observed from the table 5 that all leased in farm lands were used for agricultural purpose among sample respondents across the three gradients. In the first gradient, 6.66% of respondents leased out farm land for non-agricultural uses like parking areas, brick manufacturing etc. with a rental value of ₹ 12350 per annum per hectare. Whereas 5% of sample respondents leased out for agriculture activity with a rental value of ₹ 7410 in cash or 5 quintals of *ragi* in kind. Leasing out for non-agricultural uses was relatively higher because of high rental value compared to agricultural uses. In gradients two and three, both leasing in as well leasing out of farm land was relatively lower.

Relationship between area under non-agricultural uses and net sown area

Urbanization exerts greater pressure on agricultural land as demand for non-agricultural uses take precedence due to various factors. Therefore it is expected that there would be a negative relation between area under non-agricultural uses and net sown area in the study region. As could be observed from the table 6, there is a strong negative correlation between area under non-agricultural uses and net sown area in the high urban influence area. In the first gradient, Bengaluru urban district as well in Bengaluru North taluk, the variables under consideration were strongly and negatively correlated with the correlation co-efficient of -0.96 and -0.78 respectively and were statistically significant at one per cent level of significance indicating the strong negative association. Apart from urbanization pressure luring farm land prices is also abetting faster rate of conversion of agricultural land to non-agricultural uses.

In second gradient, Devanahalli taluk where the urban influence is relatively lower similar process was noticed, but at a much lower pace as revealed by a lower correlation coefficient of -0.56 and it was statistically significant at five per cent. But Bengaluru rural as a whole, the relationship was insignificant even though being nearer to the Bengaluru city and is mainly due to the major

establishment's viz., international airport, six lanes national highway near to Devanahalli taluk in the last decade. The relationship between the variables was insignificant at both district and taluk level in the third gradient indicating least influence of urbanization on net sown area. The results were on par with results of Eyaya (2014) who expressed that higher rate of urban expansion lead to the higher loss of agricultural land in Gondar city of Ethiopia.

CONCLUSION

Area under non-agricultural uses was exhibiting a significant positive growth in the areas with high urban influences and is more pronounced in peri-urban gradient. This was completely due to infrastructure development such as establishment of international airport and six lane national highways. And this is confirmed through the correlation analysis indicating significant negative correlation among area under non-agricultural uses and net sown area. Hence there is a need for strong policy measures to control the cascading effects of development pressures on agricultural lands led by urbanization process.

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