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THE LAND USE PATTERN CHANGES DUE TO ESTABLISHMENT OF BANGALORE INTERNATIONAL AIRPORT (BIA)

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Abstract

Studies were conducted on the impact of newly established Bangalore international airport on Land Use Change in airport area during 2009-2010. We used GIS tool to assess the Land Use Change and its intensity categorically. The Land Use Change was compared between 2002 and 2010. The results indicate the major changes the area under cultivation before establishment of BIA covered 43% of the land mass and today it's not in practice. There has been a loss by 52.83% of the water bodies and 37.32% of forest cover in its precincts. Forest cover not only has reduced quantitatively and also reduced qualitatively in terms of loss of species of high conservation values. There was negligible (0.15%) patches of land under built-up before BIA; currently 16.35% area is under built up. Earlier to BIA establishment the disturbed/excavated area was totally absent. However after BIA establishment the area increased by 48.29%.

Key Words: *land, water, forest & BIA.*

Introduction

Bangalore, capital city of Karnataka is the fifth largest metropolitan city of India. The city is well known – nationally and internationally – as a destination of choice for high –technology industries. It is a city that has transformed itself from a "pensioners' paradise" to a modern thriving cosmopolitan metropolis.

Thus, Bangalore has noticed a significant immigration of population. Growth of the city has brought with it challenges commonly associated with unpredicted growth, traffic congestion, urban sprawl, shortage of water and electricity supply and many more. Modern man's influence might practically endanger local flora and fauna and bring about drastic changes in cultivation of crops and practices, besides nationally designated conservation lands (sanctuaries and parks). Such habitats in and around populated areas like Bengaluru city that might be of conservation/heritage value, needs to be conserved and protected. Expansion of human settlements, increased land fragmentation and depletion of water resources result in decline in plant and animal species (Robinson and Qunin, 1988). Urbanization is one of the most extreme and rapidly growing anthropogenic pressures on the natural world. Urban development has led to substantial fragmentation of areas of natural habitat, resulting in significant impacts on biodiversity and disruptions to ecological processes (Christie and Hochuli, 2005).

The work on Bengaluru International Airport Ltd (BIA) was commissioned in July 2005, near Devanahalli 40 km towards north of the city of Bengaluru on the Bengaluru Hyderabad national highway. Historically Devanahalli is famous, as birth place of Tippu Sultan (was the ruler of Mysore). In May 2008, the work of BIA was completed. Because of the BIA the landscape has changed beyond recognition. The project has influenced the agricultural production and also the Bengaluru city which has been getting quality horticultural products from Devanahalli. Due to human activity and population pressure there have been changes in vegetation. The BIA was covered with the forest of woody species, agricultural lands, few built ups and with revenue land belonging to Government of Karnataka. The vegetation cover was reduced and there has been shrinkage of land resources. The main objective of this study is to document land cover changes due to construction of BIA.

Material and Methods

Observations were recorded on the changes in the landscape and the changes that may occur in near future in and around 25 Sq kms area of the BIA at Devanahalli which is located in south eastern part of Karnataka and very much near to Bengaluru city at a distance of 40 kms from on Bengaluru-hyderabad National Highway (NH 7 & 207), at Latitude 13^0 23' N and Longitude 77^0 7' E, and comes under Bengaluru Rural District. Devanahalli is 1000 m AMSL.

Satellite images were extracted from Google earth 2011 and boundary of airport was marked by digitising the compound area and polygon was created. After marking the boundary, inner land cover was digitized considering the land use classes like agriculture, water bodies, forest, built ups and barren land. After digitizing, those images were saved as KML files in Google earth; using the Quantum GIS (Geographic information system) 1.6 software, KML (Keyhole Mark up Language) files were converted to ESRI (Environmental system research institute) shape files. Using MapInfo Professional 7.0, ESRI shape files were converted into MapInfo format. Later MapInfo formatted files were used in MapInfo Professional 7.0 for editing and formatting to generate a final map. After preparation of final maps, area was estimated and land cover changes was analysed. Images used for comparison was from 'Geo Eye' by Google earth dated 12/04/2010 and Digital Globe by Google earth dated 26/04/2002. Area calculated by totalling all the landscape elements

and individual elements were analysed with the MapInfo and Graphs were plotted in the Microsoft excel.

Digitised MapInfo files of land cover 2002 and 2011 were converted to ESRI Shape files with MapInfo Professional 7.0, IDRISI 16.0 The Taiga Edition software was used to convert the ESRI shape files to IDRSI vector files, using IDRISI 16.0 the vector files were placed on the raster images and satellite image was used to correspond the same area, change analysis was done with MapInfo layers using IDRISI and rasterised and cross tabulated with two layers of 2002 and 2010.

Results and Discussion

Results revealed that totally 3949 .57 acres of land is occupied by BIA. But, there has been major landscape changes noticed considering the different landscape elements. There is a major shift in the area of landscape elements viz., agriculture, water bodies and forest (Table 1). Before the construction of BIA during 2002, out of 3949.50 acres, 1720 acres (43.54 %) was under agriculture which is totally lost at present *i.e* in 2010, resulting 100% loss. Another important landscape element *i.e* water bodies had occupied 21.05 acres (0.53%) has been reduced by 52.83% constituting 9.92 acres (0.25%) at present. The crucial landscape element that supports biodiversity *i.e* forest during 2002 was represented with good vegetation cover of 2202.45 acres (55.76%), it has been reduced by 37.32% resulting in 1380 acres (34.95%) by 2010. In contrast to the loss of aforesaid landscape elements, there is an increased extent in built up and barren landscape of the BIA area. During 2002 the former landscape was of 6.07 acres (0.15%) have been increased by 652 acres (16.51%). While, the later one is 1906.03 acres that constitutes 48.29% in 2010 was not in the scenario during 2002 (Table 2).

Change Analysis

Change in land use has been studied and the results were as follows. Forest area which is still retained is 1167.64 acres, water bodies converted to plantation is 3.35 acres, agriculture to plantations is 206.22 acres, agriculture to water bodies 9.90 acres following forest to built-up is 331.38, water bodies to built-up is 3.78, agriculture to built-up is 310.27, forest to barren is 700.46, water to barren is 13.10, built-up to barren is 6.11 and agriculture to barren land is 1192.07 acres (Plate 1 &2).

Due to the development of BIA there have been drastic landscape changes from 2004 to date. Earlier to the establishment of BIA, the landscape included wild and cultivated vegetation patches with different kinds of habitats like scrub, cultivated land with sparsely thorns scrub, wet patches and patches covered with tree cover. Today the whole habitat has been rendered uniform with 16.35% of built up and 48.29% of the area excavated and kept as barren for further developmental build ups. Earlier, in the present airport area, 43.50% was under crop land where as now, completely it has vanished. These crop lands were changed to build ups, barren and rest of the land was planted with monoculture plantations of *Acacia* species and *Eucalyptus.* This has a great impact on the native biodiversity which leads to the species turnover of a given faunal community. The adopted species get replaced by certain species which prefer the habitat with open canopy (plantations) account to the loss of native faunal community and hence, contribute to the species turn over.

Whereas due to loss of agriculture land, the indigenous crop species have been lost viz., fruit crops *(Citrus grandis L.* locally known as chakotha, mango, grapes, *Annona squamosa*, *Annona reticulate*); cultivated crops viz., ragi, mulberry, fodder sorghum and maize; vegetables like tomato, brinjal, etc.; and flower crops like spetika, jasmine, rose. The disappearance of the aforesaid crops might have affected small scale farmers' livelihood. Considering the water bodies comparing with 2002 there was a loss in 52.83% in 2010 and it's been converted into built ups and excavated to barren for further developments. Whereas forest cover before included plantations of *Acacia* and *Eucaluptus* after the construction of BIA it has been decreased by 37.32% these forest land has been deforested for other developmental activities like buildings, barren and around 40% is left as it is. Srinivasalu (2008) also indicated in his study that Hyderabad International Airport, 30 km from the city is established at the destruction of green cover which has a major impact on the environment. Brahmbhatt *et al*. (2000) studied the temporal changes in land use/ land cover using multi temporal satellite data in Mahi right bank canal command area in Gujarat they opined that remote sensing based study showed the aerial extent of the degraded lands that would be helpful for planning proper reclamation measures.

Also, in the similar urbanization study by Pauchard *et al.* (2006) found that the impacts of urban sprawl on biodiversity in the metropolitan area of Concepcion differ little from cities in other parts of the world, native ecosystems are replaced by pavements and buildings and what is left of the natural soil is covered with green areas dominated by non-native ornamental species. Wetlands and other peri-urban ecosystems are rapidly being destroyed, fragmented or invaded by non-native species. In the study area of 32,000 ha, there was a net loss to urbanization of 1734 ha of wetlands (23% of the original) and 1417 ha (9%) of agricultural, forest and shrub land cover types between 1975 and 2000. From the total area urbanized (3151 ha), 55% corresponded to wetlands and 45% to agricultural, forest and shrub lands cover types.

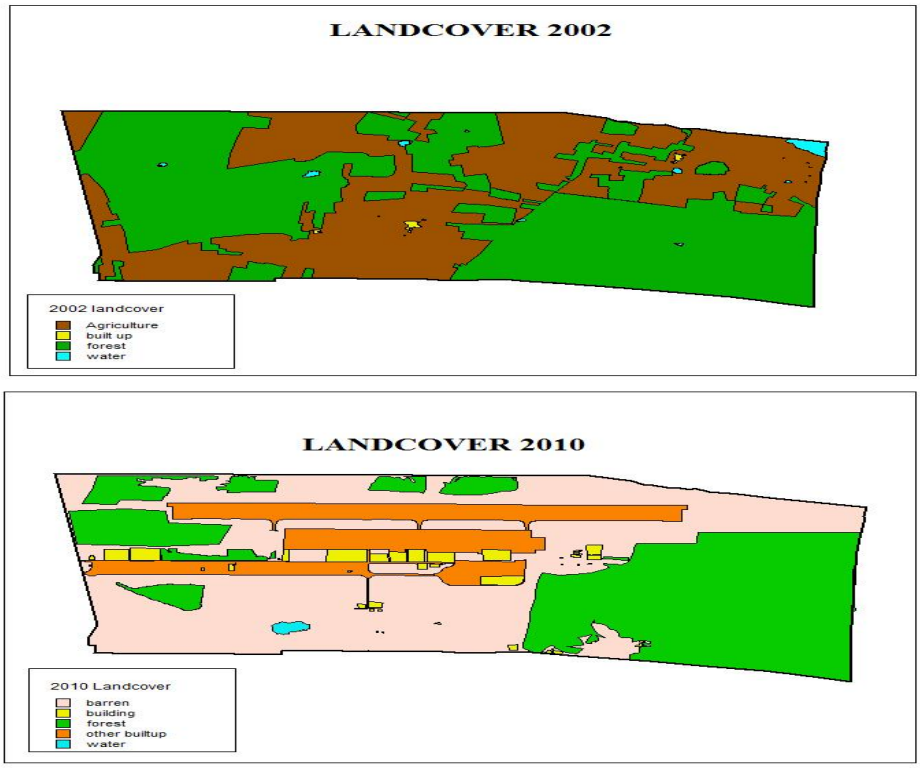

Plate 1. Land cover pattern during 2002 and 2010

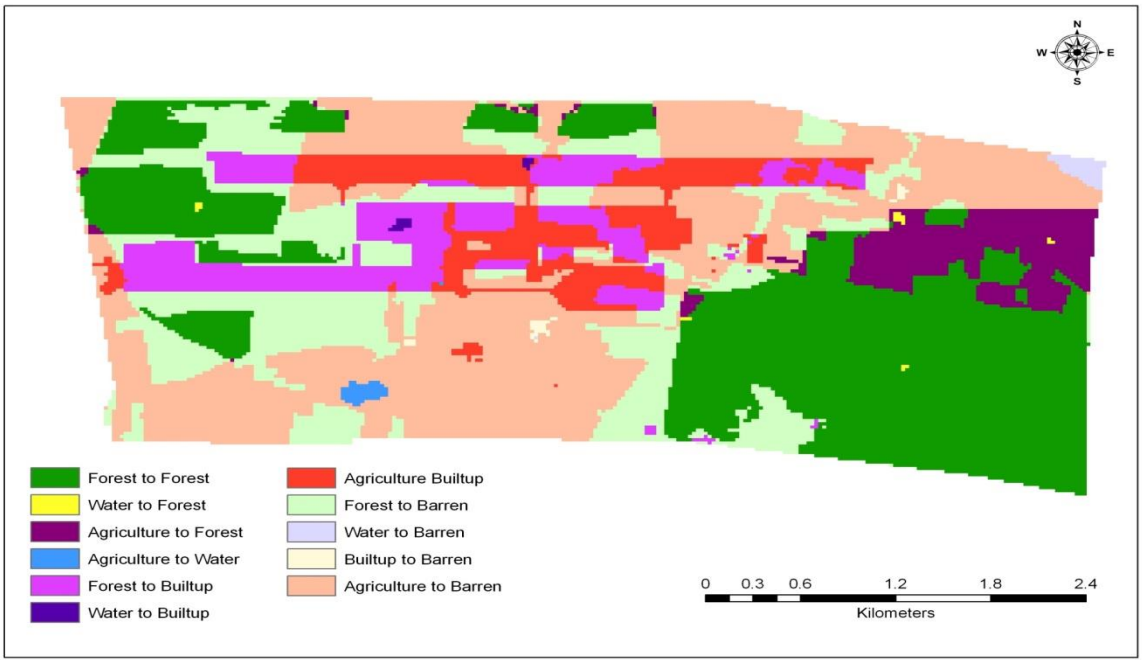

Plate 2. Land cover change pattern comparisons

Table 1. Conversion of land use pattern during years 2002 and 2010

Change Pattern	Area (ac)	Percent changes
Forest to Forest	1167.64	53.02
Water to Forest	3.35	15.90
Agriculture to Forest	206.22	11.99
Agriculture to Water	9.90	0.58
Forest to Built-up	331.38	15.05
Water to Built-up	3.78	17.97
Agriculture Built-up	310.27	18.04
Forest to Barren	700.46	31.80
Water to Barren	13.10	62.22
Built-up to Barren	6.11	90.29
Agriculture to Barren	1192.07	69.31

Table 2. Changes in the area and Percent loss of extent area of landscape elements between 2002 (before) and 2010 (after) establishment of BIA

Landscape elements	Total area (acres)		Total airport area (acres)	Percent class (%) 2002	Percent class (%) 2010	Landscape changes in percent (%)
	2002	2010				
Agriculture	1720	0	**3949.57**	43.55	0	-100.00
Water bodies	21.05	9.92		0.53	0.25	-52.83
Forest	2202.45	1380		55.76	34.95	-37.32
Built up	6.07	652		0.15	16.51	16.35
Barren	0.00	1906.63		0.00	48.29	48.29

Due to development of BIA cultivation of land has ceased, native people have lost their occupation and profession families here were rehabilitated and there by natural resources have been poorly compensated.

As per the digitized maps estimates with GIS tools, the area under cultivation before establishment of BIA covered 43% of the land mass and today it's not in practice. There has been a loss by 52.83% of the water bodies and 37.32% of forest cover in its precincts. Forest cover not only has reduced quantitatively and also reduced qualitatively in terms of loss of species of high conservation values. There was negligible (0.15%) patches of land under built-up before BIA; currently 16.35% area is under built up. Earlier to BIA establishment the disturbed/excavated area was totally absent. However after BIA establishment the area increased by 48.29%.

Reference

BRAHMBHATT, V.S., DALWADI, G.B., CHABBRA, S.B., RAY, S.S. AND DADHWAL, V.K. (2000). Land use/ land cover mapping in Mahi canal command area, Gujarat using multi temporal data. *J.Indian. Soc., Remote sensing.,* **28** (4): 221-232.

CHRISTIE, F. J. AND HOCHULI, D. F. (2005). Elevated levels of herbivore in urban landscapes: Are declines in tree health more than an edge effect? *Ecol. Soc.,* **10**(1):1–9.

PAUCHARD ANIBAL., MAURICIO AGUAYO., EDUARDO PENA. AND ROBERTO URRUTIA. (2006). Multiple effects of urbanization on the biodiversity of developing countries: The case of a fast- growing metropolitan area (Concepcion, Chile). *Biol. Cons.*, **127**: 272-281.

ROBINSON, G.R., and QUNIN, J. F. (1988). Extinction, turnover and species diversity in an experimentally fragmented California annual grassland. *Oecologia* (Berlin) **76**:71-82.

SRINIVASULU, C. (2008). Urbanization and biodiversity loss –Where is Hyderabad heading?. *Curr. Sci.*, **94**(10):1233-1234.