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Measure, and Predict Shifts in Urban Land Usage in Jorhat District

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Abstract – The river bed is very narrow and, as a result, the river reaches the danger point within 12 hours of precipitation during the flood season. The river has a strong propensity to alter its courses during heavy flood times owing to the shallowness of the river portion and low lying adjoining regions. J Orhat and its suburbs were flooded in May 1977 owing to unprecedented and concentrated rainfall. Owing to poor drainage of the Tocklai and Tarajan drains, the problem was further exacerbated. It has created flood congestion due to the backwater movement of the river through the Tocklai canal, triggering floods and water logging in most areas of Jorhat, as the bed of the river Bhogdoi is higher than the level of the district. Thus, it has been shown that the intervention of man with natural drainage and its impact is maybe no more plainly evident than in the town of Jorhat. The embankment along the river Bhogodi has proven to be both a blessing and a curse for the region. They are helpful in the way that they shield the metropolitan environment from destructive flooding, but they are a curse since they do not enable water to be pumped out easily and therefore trigger water-logging in city areas. In comparison, the rise in the development of the city's badly drained low-lying zones, where no technological drainage scheme has been implemented, has rendered the problem worse. Following heavy rainfall, water-logging in the low-lying areas has become a frequent feature during the rainy seasons.

Keywords – Jorhat, Exacerbated. Shallowness, Flooded

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INTRODUCTION

POPULATION PRESSURE AND LAND USE

An appreciation of socio-economic activity trends and processes Vital aspects of the spatial arrangement of urban and rural populations are important in terms of space (physiography, place, etc.) between towns and their local areas for the design of socio-economic growth and transition policies. Rivera (1973) proposed a methodology for land use zoning. The applicability of this suggested approach tends to be confined to upland watersheds where agricultural production is prevalent. Now a day the population grows urbanised and the influence of the region on its rural communities is certainly of considerable importance. Huson (2001) also experimented with the pattern of the metropolitan city of Chicago and two issues were reported. The first challenge confronting the community is that it has little sufficient drainage since the city grew in the 19th century through the bed of the old Chicago Lake. Many geographers discussed the development problems of the cities; these were primarily restricted to the analysis of urban settlements as discrete units with little regard for the physiographic area.

INTRODUCTION TO THE FIELD OF ANALYSIS

Jorhat, one of Assam's major urban centers, with its urban agglomeration (UA) since 2001 as per the Census of India, 2001 and 2011), has been listed as a 'C' class city under Class I UAs / Towns (as reported by Jorhat Municipal Board, Assam / Web Directory, 2001). The city acts as a gateway to upper Assam and neighbouring Nagaland province. It has grown to be one of the state's largest commercial and industry hubs. Jorhat 's experience of development, like most metropolitan centres, is eventful and is one of the incremental transitions and assimilation of numerous cultural characteristics that have evolved over various phases of its experience.

Temperature

The monthly average of the maximum and minimum mean temperature reported for the summer is 28.5 ° C and 21.2 ° C; 23.5 ° C and 12.6 ° C for the winter; 31.7 ° C and 26.9 ° C for the monsoon season; and 28.0 ° C and 20.5 ° C for the post monsoon. At the Tocklai Tea Research Institute, the minimum temperature shift was reported over time for Jorhat,

indicating an growing pattern. On average, the minimum temperature has raised over the last 90 years by 1.40 ° C. Whereas the maximum temperature in Jorhat also rises with the amount of days with a maximum temperature of more than 35 ° C, as reported at Tocklai, the maximum temperature in Jorhat has also increased significantly (Baruah & Bhagat, 2014). This meteorological and environment regime points to climate-induced risks, the consequences of which will multiply if environmental planning and management are not taken into account. The temperature can then be grouped into:

(i) Winter (from December until March)

(ii) Summer (from April till June)

(iii) Monsoon (from July until September)

(iv) Autumn (from October till November)

Geology

The region is underpinned by unconsolidated Quaternary Period alluvial sediments, which can be divided into I older and (ii) younger alluviums. The older alluvium occupies sediments of an oxidised and comparatively dense disposition in the upland regions, while the younger alluvium exists along the river courses along the low-lying tracts of the region. Adjacent to the Naga hill range, the southern part of the region is protected by a surface blanket of clay, belonging to the younger alluvium, and possibly originating from the adjacent hills consisting of Tertiary-age rocks. The geological past of the upper Brahmaputra valley and thus of the Jorhat region is recorded to be connected to the two long narrow subsiding geosyncline troughs known as Tethys, which lie on either side of an old rigid continental shield (foreland). Its southwest portion is the continuation of the plateaus of the foreland of the Shillong and Mikir hills and is linked by a broad thickness of alluvium and tertiary rocks in the valley (Sharma, 2010). The geological history up to the Tertiary era of the rest of the area of Assam is fragmentary. Relatively recent alluvium deposits at the beginning of the Tertiary period occupy much of the Jorhat deposited by the Brahmaputra River and its tributaries such as Bhogdoi, Kakadonga, etc. The older alluvium, largely from the Pleistocene era, consists of reddish to brownish sandy mud along the plains of the Brahmaputra River with coarse particles of sand, silt and clay. There is a thin strip of rock along the district's southern frontier that is assumed to be developed during the Miocene period and is locally recognised as the Tipam sequence of sedimentary rocks defined predominantly by coarse to gritty, ferruginous sandstone and shales (NBSS & LUP, 1993).

Soil the Soil

The Jorhat plains, which are part of the Brahmaputra alluvium, comprise of both old and modern forms of alluvium. Nevertheless, regions in the vicinity of the city are built mainly of fresh alluvial deposits. Current alluvial soils typically consist of fine gyro-white sand in the deeper fields, thinly covered by a sheet of clay. The older alluvial soil ranges in hue from sandy loam to silty and clayey-loam to medium brown to medium yellowish brown. Jorhat's uplands have sandy loam soil. From loamy sand to silty clay loam, the flood plain comprises of different soil textures. In comparison, Jorhat's low-lying plains have soils with the top of silty clay loam as this alluvium fields are more consolidated and mainly sandy, clay decomposition. Jorhat 's soil is less acidic in answer (pH 4.5 to mildly alkaline) and is thus ideal for tea planting and high in phospahate and exchangeable calcium abundant (6 to 21 m.e. per 100 gm of soil). Nitrogen content is very moderate (nearly 10%) (Barua, 1964 & Sharma, 2010). Jorhat overall consists of textured coarser clay, ranging from loamy sand, sandy loam, and silt loam. The soils are of residual origin in the southern sections of Jorhat, originating from the semi-consolidated rocks underlying these regions.

Vegetation that is natural

Jorhat 's environment and soil conditions are shown to be favourable to the production and growth of a range of natural vegetation, including tropical evergreen and semi evergreen trees, some shrubs and herbs, and some grasses. Reserve forests such as Disoi, Tiru, Kakadonga, etc. are found in the hilly ranges and Piedmont regions. These forests are distinguished by the dominance of a variety of important species of trees, including Hollang (Dipterocarpus Macrocarpas), Sam (Artocarps Chaplasha), Amari (Amoora Wallichi), Sopas (Mcheliai spp.), Bhelu (Tetramels Mudiflora) and Hingori (Castanopsis Spp), Boga Koroi (Aivizzia Procera), Khokan (Duabhanga Sonneratioides), Nahar (Mesua Ferrea), etc. For the plywood industries of upper Assam, the Hollong and Makai provide raw materials, while Nahar is mainly used as timber. Ajhar (Lagesrstroemia Jlosregmae), Udal (Sterculid Villosa), Bandordima (Dysoxylum Procerum), Dhuna (Conarium Resiniferum), Bhomora (Terminalia Belerica), Ful Gomari (Gmelina Sp.) and so on are also extensively present in the area. Bon Agora (Triumfetta Rotundifolia), Bojal Bamboo (Pseudostachyam Polymorphum), Dhekialata (Stenochola), Dolu Bamboo (Teinosstachyum Dullooa), Hauka Bet (Calamus spp.), Jatibet (Calamus Tenuis), Kaupat (Phrynium Imbricatum), Tati (Calamus opp.), Jengu (Calamus Eractors), Tora (Alpinia Allughas), Sorat (Laported Cremulata), and so on are common shrubs and herbs. This place is well recognised for its various varieties of marvellous orchids. Kapauful (Rhyncostylists Retusa) and Bhataufu/ are typical strains. In addition, the uplands are often dominated by the production of tea. The valley has been found to be ideal for the production of a number of paddy-dominated crops. Tropical and sub-tropical fruit

varieties are also cultivated in the district's highlands.

Wastewater the Wastewater

A close drainage network that originates in the southern and other highlands of the Naga Hills washes Jorhat. There are two rivers, of which the Bhogdoi is one, and there are several other streams. They are classified as Jans locally. The Bhogdoi River empties itself into the mighty Brahmaputra River, which sits on the city's northern side and runs from east to west.

Gently sloping from south east to North West due to the elevation of the area, it has a dominant impact in triggering the north-west flow of the Bhogdoi River, a Brahmaputra tributary, and the four streams, viz. In the city district, which flows parallel to Bhogdoi, Tarajan, Tocklai, Anthubhanga, and Jawkharia. There are, however, five large drainage basins comprising the whole city of Jorhat (Fig.1.6) (Tarajan, Tocklai, Anthubhanga, Jawkharia and Rowriah) and a sub-ordinate basin (Mahuajan). Tarajan and Tocklai are more significant among these basins than the other basins that cover sensitive civic areas where the issue of drainage is acute. The drainage from the north-east side of the Bhogdoi River is drained by the Jawkharia that passes the Assam Trunk (A.T.) road by Chengeli Gaon and crosses National Highway 37. Bye-pass to Gaon Kolakhua. The Tocklai river drains the area between South-West side of the Bhogdoi river and east side of Garh-ali and Jorhat Baligaon road, passing though Tocklai T.E, Na-kari Gaon and Crosses N.H. Pass by Sensua Gaon and enter Bhogdoi on a long stream downstream

Trend of Decadal development

The population was 2,899 during 1901 (which is also the year of creation of the municipality of Jorhat), which increased to 16,164 in 1951, showing an absolute variation of +13265, which is almost 6 times the population rise over these 50 years , showing a rise of 457.6 percent over this period , i.e. 4.6 times the rise over the last 50 years. Again, population increase between 1951-2001 was 318.13 trillion, i.e. 3.2 times for a further 50 years. Therefore, during the last 100 years (1901-2001), population increase has been 22.31 times (that is 2231.42%) (Fig.1.10 and Table 1.5). Subsequently, the area of the Jorhat master plan (which was extended in 1941 as the Master Plan area). Accordingly, the city has undergone a growth of 330.225 percent during the last 60 years (1941-2001), i.e. 3.30 times (Fig.1.10 and Table 1.), indicating a steep population rise.

Table 1. Areal expansion of Jorhat city, 1961-1990

Year	Municipal Area (sq. km)	Master Plan Area (sq. km.)	Percentage increase During 1960-1990	
			Municipality Area	Master Plan Area
1961	4.95	15.85	-	-
1990	9.20	72.58	85.86	357.89

Source: Master Plan Area of Jorhat, 1990; Sharma (2010); Census of India, 1971, 2001, 2011

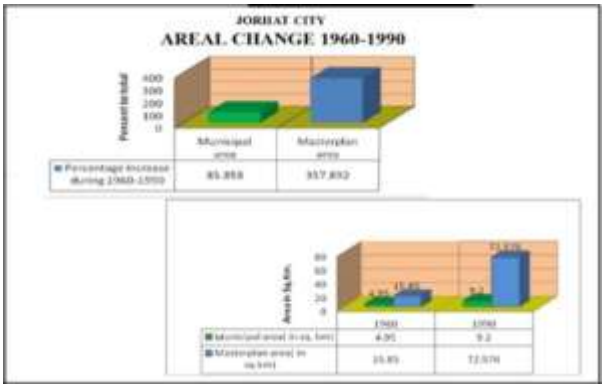

Fig. 1. Areal change of Jorhat municipal and master plan area (1960-1990)

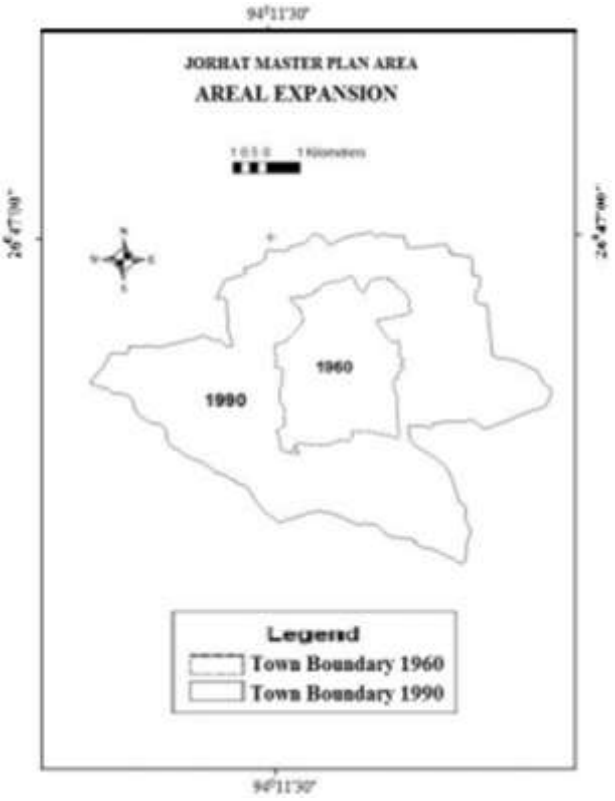

Fig.2 Areal expansion of Jorhat master plan area (1960 -1990)

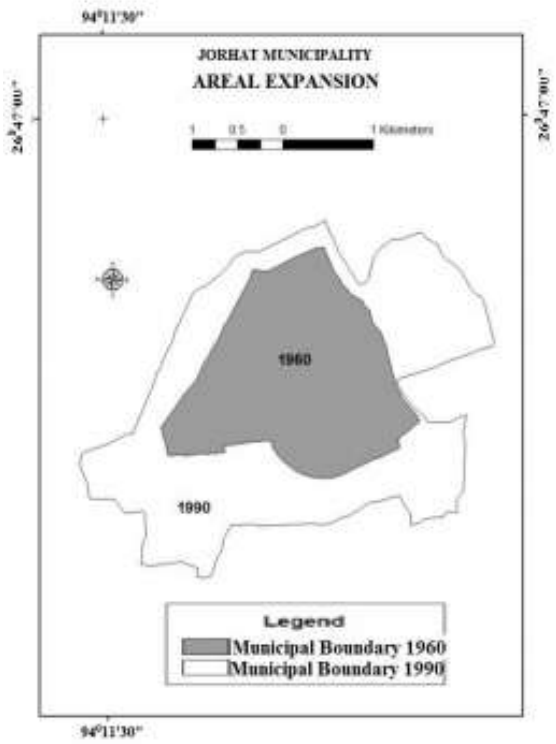

Fig. 3 Areal expansion of Jorhat municipality (1960- 1990)

Fig. Fig.2 illustrates the portion of Jorhat 's development during the 1960-1990 period with a geographic expansion of 15.85 sq.km to 72.58 sq.km covering the same volume of land in 2014. Of this 72.58 sq.km of overall master plan land, roughly 23.13 sq.km is formed representing about 31.9 percent of the total area of the master plan (TCPO, Jorhat, 1990).

Figure 3 demonstrates the geographical growth of the municipality of Jorhat from 1960 to 1990, with the overall area of the municipality increasing from 4.95 sq. Km to sq. 9.20. The Km. It forms around 7% of Jorhat 's total planning area. During 1960, it was built with six wards, which was further expanded to nineteen wards after the 1980s.

OBJECTIVES OF THE STUDY

1. To evaluate, measure, and predict shifts in urban land usage.

2. To evaluate, in terms of its geometry, flow characteristics and drainage morphology, both the natural and man-made drainage system of the study region

CONCLUSION

In addition, for any particular position of Jorhat, morphometry of drainage basin based on distance, density and discharge is studied. First, all the drains are divided into tiny (0-1.3 m), medium (1.3-16 m) and big (over 1.6 m) drains. Considering the minimum and maximum drain width of the city, the range of these drains has been adopted. The measured statistics given a predefined observation that higher drainage density is executed by smaller drains relative to larger drains. Therefore, it may be stated that there is an immediate need to turn smaller drains into larger drains in order to meet the carrying power, taking into consideration, whenever necessary, the spacing of the drains and also the width of the road in that specific area. The association between population and drainage density is also discussed together with these studies, where it is observed that 80% of drainage density is clarified by population density for 2011 and 84% for 2001.

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