



## GIS based accessibility analysis : a study on health care services in Jorhat district of Assam.

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### Abstract

Health care service is regarded as one of the key factor for complete development of a society. In present time, there are lots of people from rural areas which have very poor access to medical facilities. In comparison to the other districts of Assam, Jorhat district holds first rank in state Human Development Index, 2003. But there are some places within the district where medical facilities are not available and even where available those are not satisfactory. Therefore, an attempt has been made in this paper to explore the accessibility level of health care services using database like health centres location and major road network layers under GIS environment. It has been observed that among the eight development blocks of the district, the North-West and Titabar development blocks have registered highest number of primary health centre (PHC) and sub-health centres. The study is considered to be helpful in assessing spatial status of health care services and its proper development in future.

**Keywords:** health care services, access to health services, GIS, Jorhat district.

### 1. Introduction

The Constitution of the World Health Organisation (WHO) defines 'health as a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity' (Joe, 2010). Good health is an integral part of high state of people's personal well-being and also part of human development. On the other hand health care service with high quality and easy accessibility is regarded as one of the key factor for complete development of our society. 'Good health care facilities and services are essential input for creating healthy citizens and society that can effectively contribute for overall human resource development' (Kore, 2014).

'Access' to healthcare is a broadly based conceptual term used to describe a group's or an individual's ability to obtain needed medical services (Institute of Medicine, 1993, Wilson, Kratzke and Hoxmeier, 2012). Though inequality in health

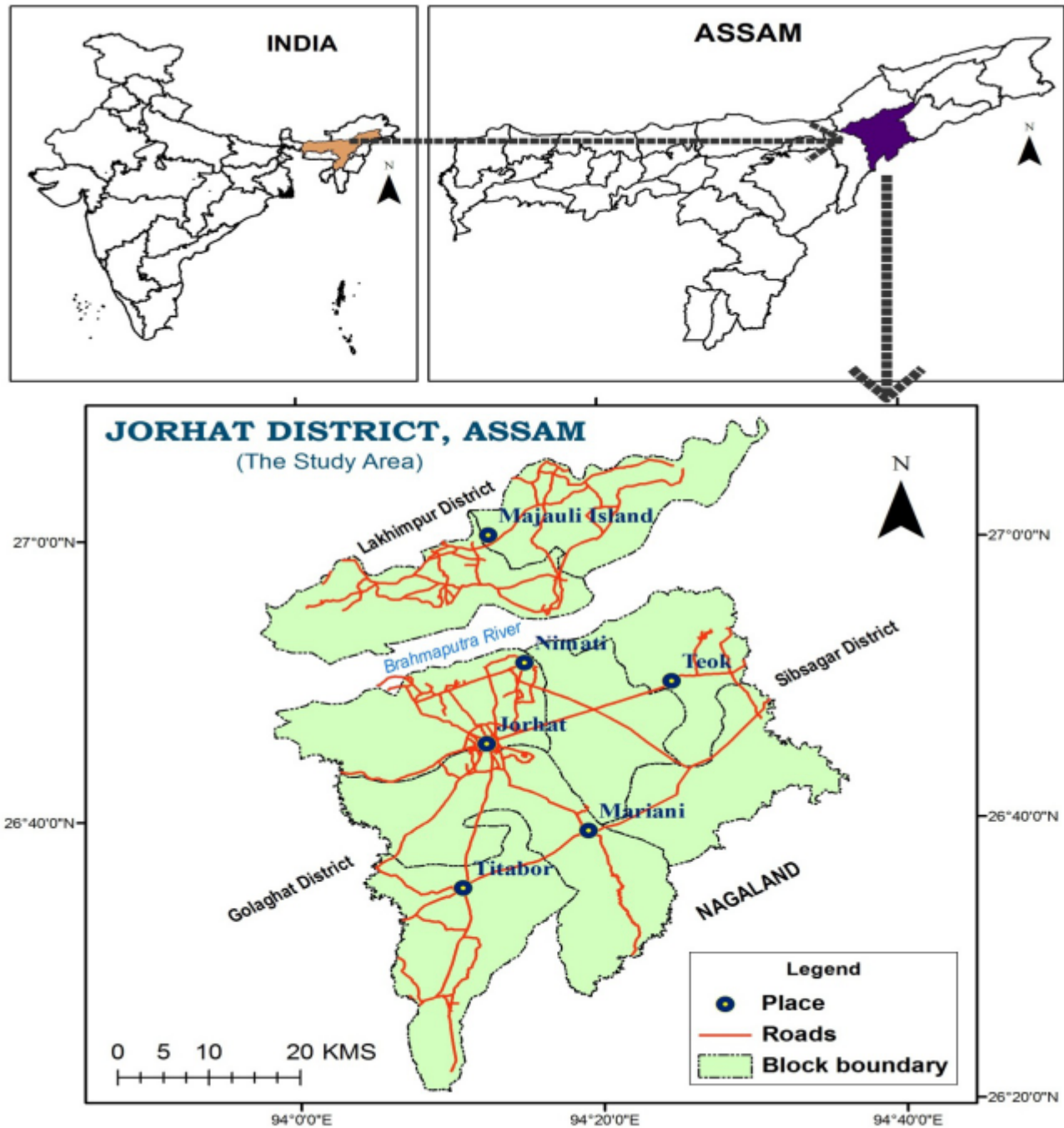
services is apparent between rural and urban areas, access to health service is also determined by several economic and social factors in addition to the infrastructure. 'Lack of access to healthcare is frequently cited as a primary reason for health disparities globally' (Wilson, Kratzke and Hoxmeier, 2012). In spite of several attempts by the government to improve the health facilities in Assam, there are a lot of people in rural areas persistently having the problems of quality and accessibility to medical facilities mainly in terms of distance and transportation problems. There are some places within the district where medical facilities are not available and even where available those are not satisfactory. Therefore it is an attempt to explore the overall accessibility level of health care services in Jorhat district and accessibility to the same at village level in the same district. Recent research has witnessed ever-increasing engagement with this issue thus

creating a huge body of academic literature that systematically documents socio-economic inequalities in health in varying contexts (Joe, 2010).

**2. The study area**

The study area (Fig 1) is Jorhat district of the State of Assam. It is bounded by Lakhimpur district on the north, Sibsagar district in the east, Golaghat

district in the west, and the south is flanked by Naga Hills. The area of the district is 2,852 sq. k.m. and population is 1,091,295 (2011). The district comprises three sub-divisions, six revenue circles, and eight development blocks namely Jorhat (Baghchung), North-West Jorhat (Dhekorgarah), Central Jorhat (Chipahikhola), Kaliapani, East Jorhat (Selenghat), Titabor, Majuli and Ujoni Majuli.



**Fig. 1 : Study Area**

### 3. Objectives

1. To show the distribution of health centres in the eight development blocks of Jorhat district.
2. To analyse district level and the village level accessibility of health care services in the district.

### 4. Database and methodology

#### 4.1 Data sources

This paper is based on secondary data obtained from the District Statistical Handbook, Assam Statistical Handbook, The Village and Town Directory, Assam, Planning map of Jorhat District etc.

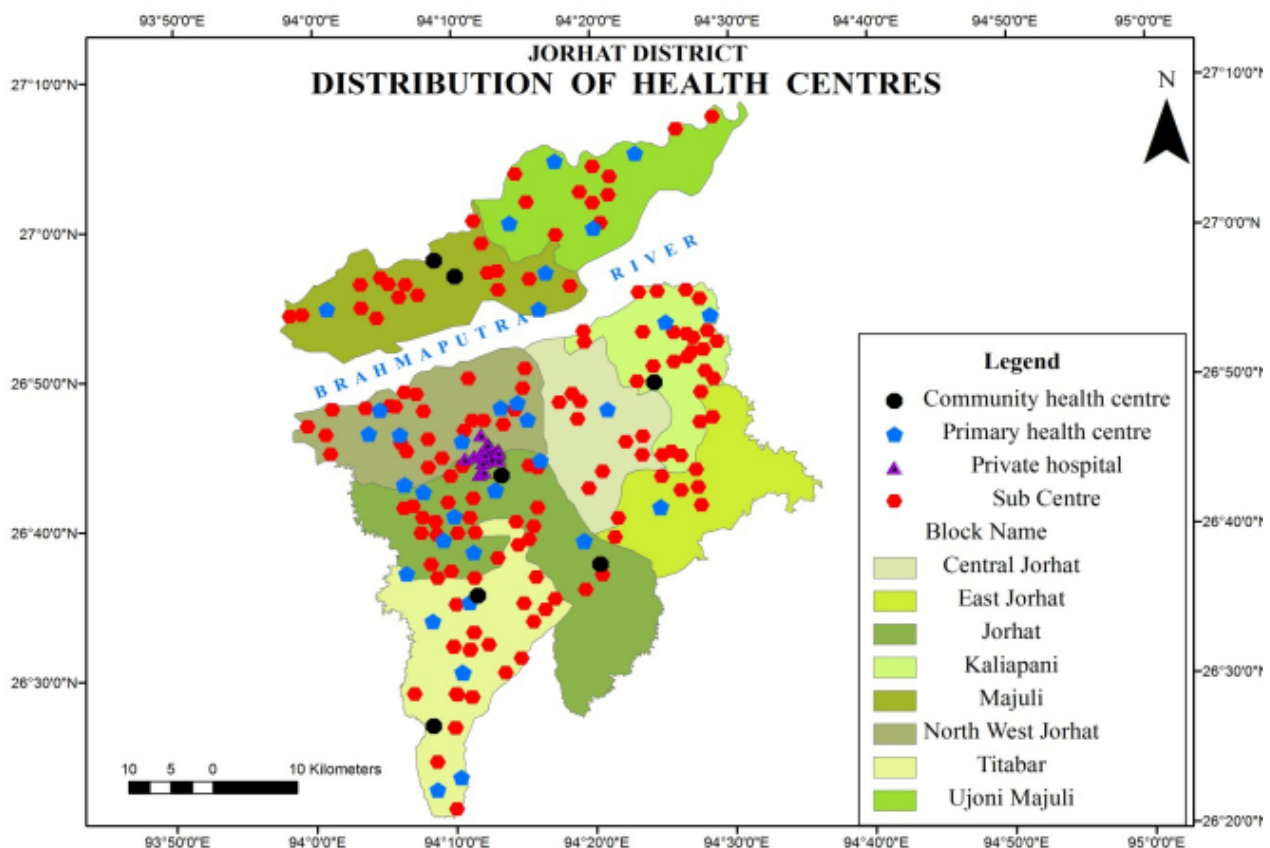
#### 4.2 Methods

To show the accessibility to health services at first location of the health centres are digitized and after that 'point density map' is prepared in Arc GIS. Like point density, a 'line density map' is also prepared for road network in Jorhat district. To find out best accessible zones, raster overlay is done through

'Weighted Sum Index' for both point density and line density map. In terms of distance from the major road network, health centre locations and major road network layers are prepared under GIS environment. In this regard, from the road layer, three multi ring buffer layers are created i.e. within 500m, within 500m to 1000m and within 1000m to 2000m in GIS environment. After that, villages are selected which intersect the health centres within the 500m, 500-1000m and 1000-2000m buffer.

### 5. Results and discussion

Figure-2 shows the distribution of health centres (Primary health centre, Community health centre, Sub-centre and private hospitals) in the eight development blocks of Jorhat district. The highest number of health centres including primary, community, sub-centre is in Titabar development block (32) followed by North-West Jorhat (31) and Jorhat development block (30).



*Source:* State disaster management authority, Assam

**Fig. 2 :** Distribution of health centres, Jorhat district

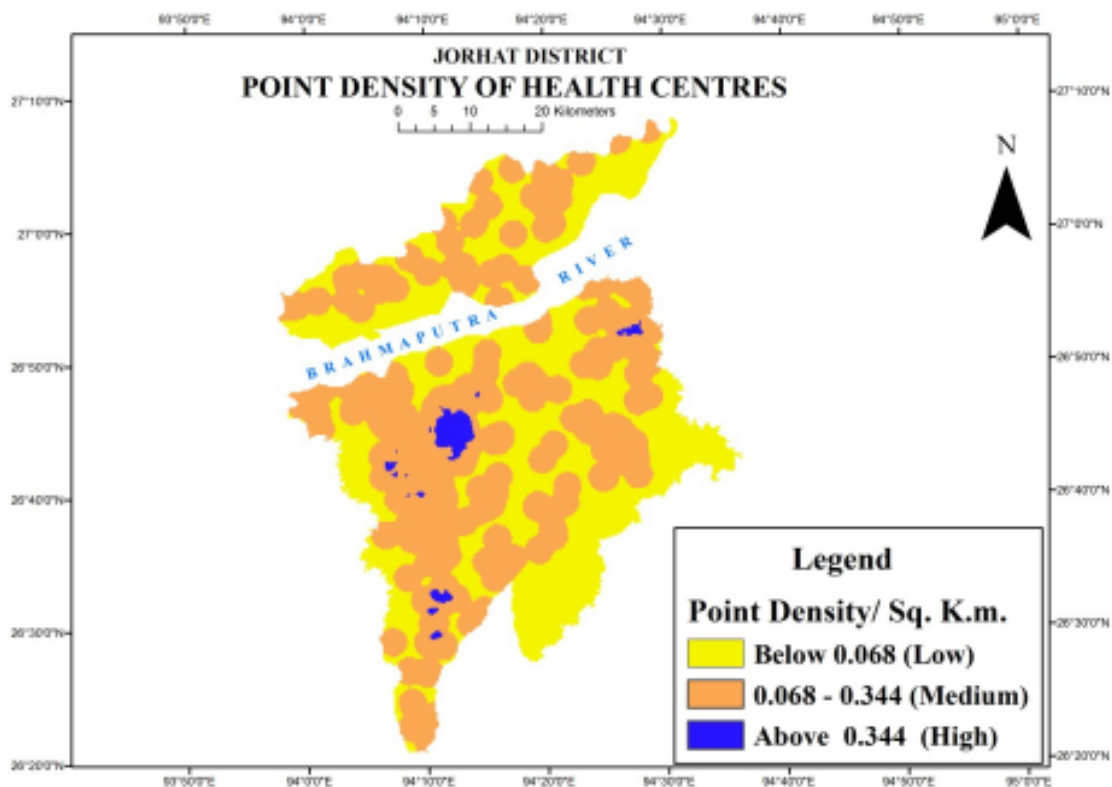
**Table 1:** Block wise total no. of Health Centres in Jorhat district.

Block Name	Total no. health centre	Primary health centre	Sub-centre	Community health centre	Private hospital
Ujoni Majuli	22	3	17	2	0
Majuli	15	4	11	0	0
North-West Jorhat	31	8	23	0	0
Central Jorhat	10	1	9	0	0
Kaliapani	28	2	25	1	0
Jorhat Development	30	7	21	2	0
East Jorhat	9	1	8	0	0
Titabar	32	6	24	2	0
Jorhat Municipality Board	17	0	0	0	17

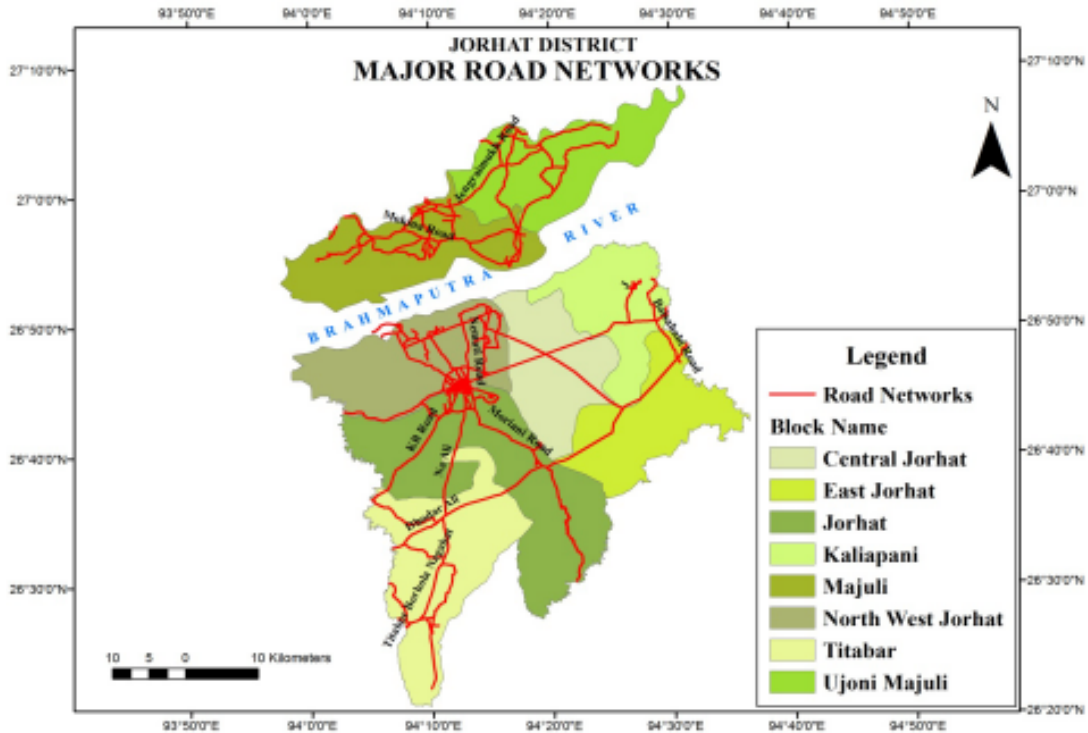
**Source:** State Disaster Management Authority, Assam

On the basis of this location of points, a point density map is prepared in Arc GIS and divided into three zones i. e. low density, medium density and high density in comparatively terms. The high density areas are found in and around urban areas

like Jorhat, Titabar and Teok (*fig.3*). The low density areas are found in border areas near Nagaland and in some rural areas. However medium point density is found in substantial areas of the district (*Fig.3*).



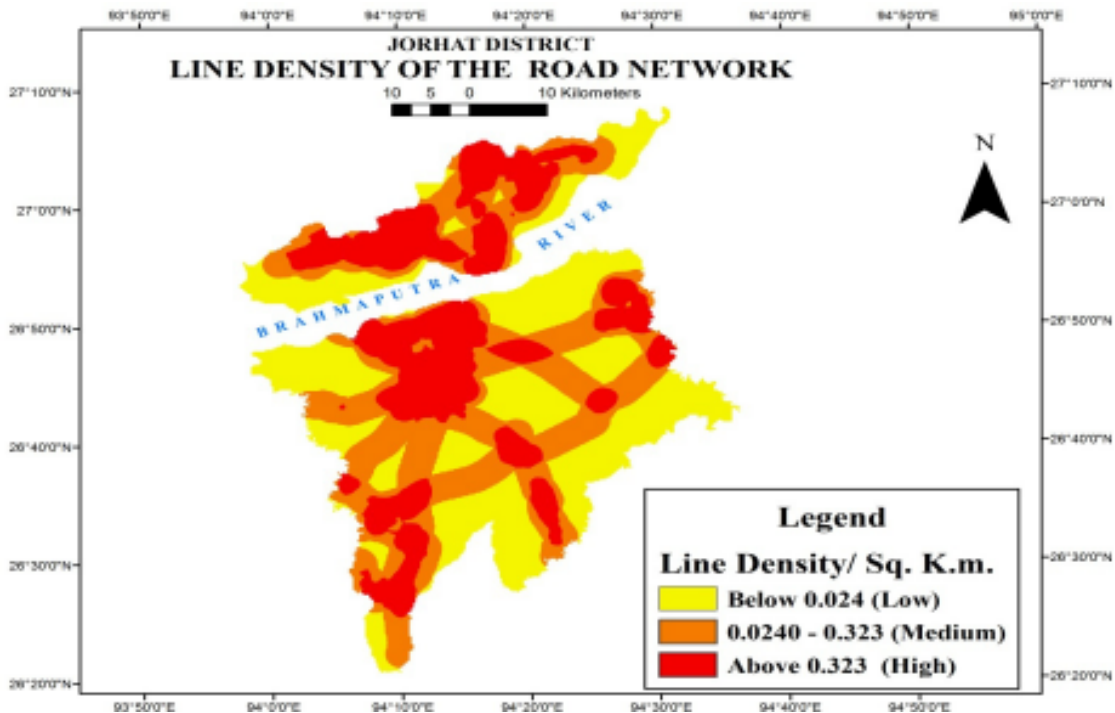
**Fig. 3 :** Point Density of health centres/sq.k.m., Jorhat district, Assam.



**Fig. 4 :** Road Networks, Jorhat district, Assam

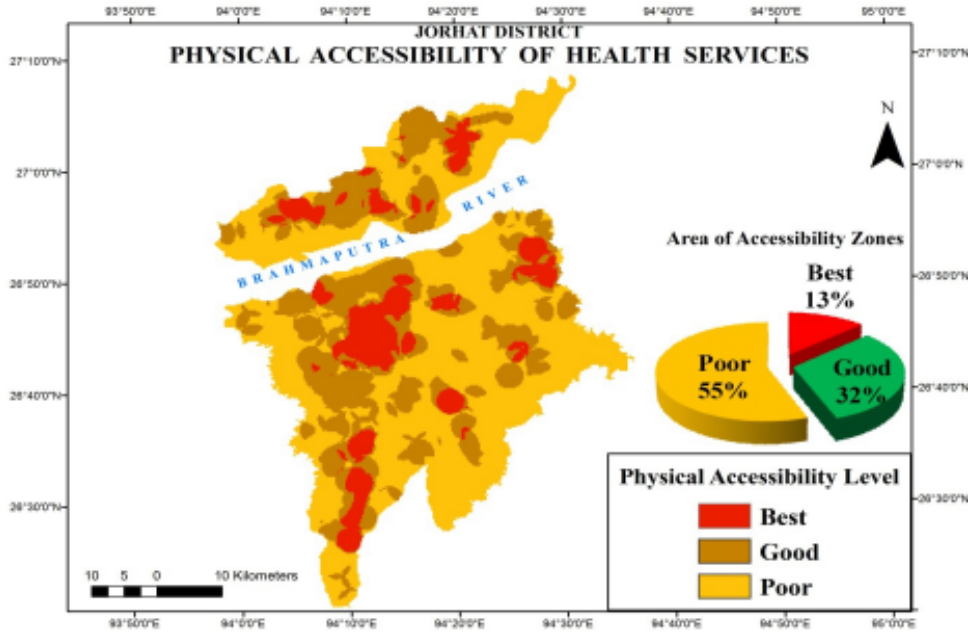
Again on the basis of road network map (Fig. 4), a line density map is prepared and three zones of low, medium and high line density are found. Again like point density, highest line density is found in and

around urban areas. It is also found in nodes formed by transportation line (Fig.5). Low density areas are those rural areas which are far away from road networks.



**Fig. 5 :** Line Density/sq.k.m. of Road Network, Jorhat district, Assam



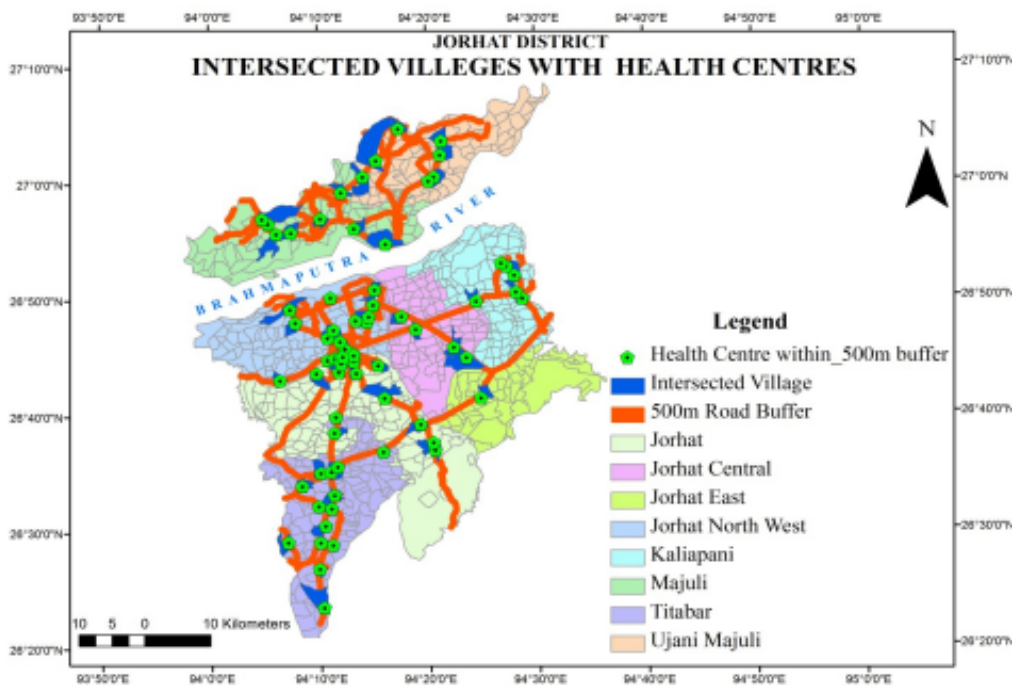


**Fig. 6 :** Physical Accessibility level of Health Services, Jorhat district, Assam

After raster overlaying (using weighted Sum Index) these point density of health centres and line density of road networks, a final map is prepared and three zones of best, good and poor accessibility are identified. In the map red colour indicates areas with high accessibility to health services, brown colour indicates moderate accessibility and yellow portion indicates low accessibility to health services.

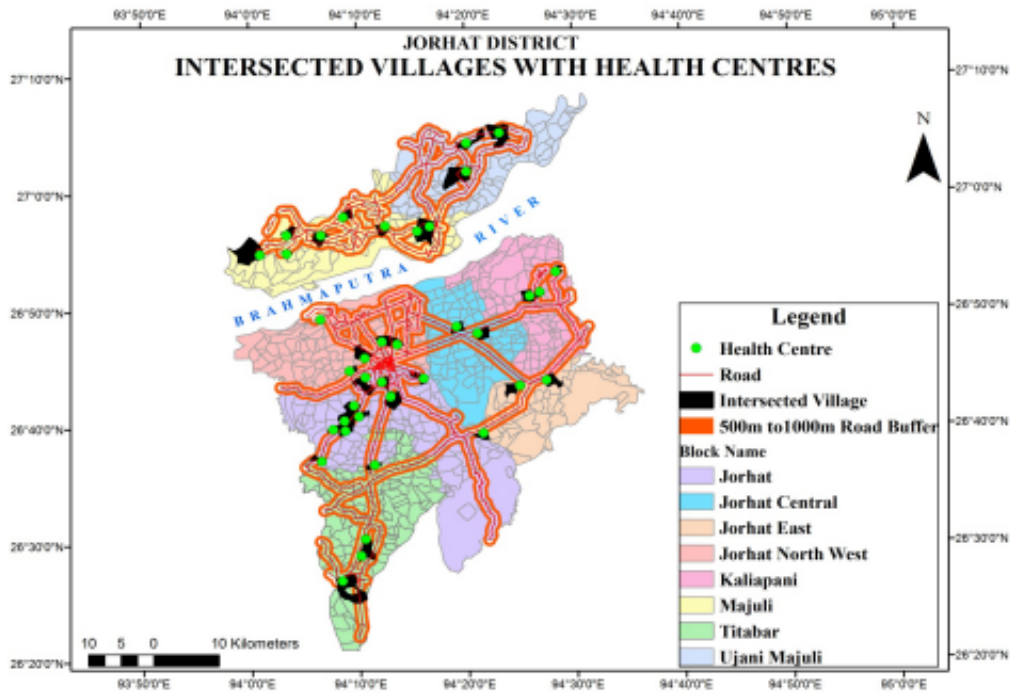
**6. Accessibility of the villages**

Figure-7 shows the 500m buffer from the major roads in the eight development blocks of Jorhat district. The health centres and villages lying in this zone are intersected and the villages which can avail health services easily are identified. In the figure7, blue colour indicates the villages which can avail health facility more easily than the others.



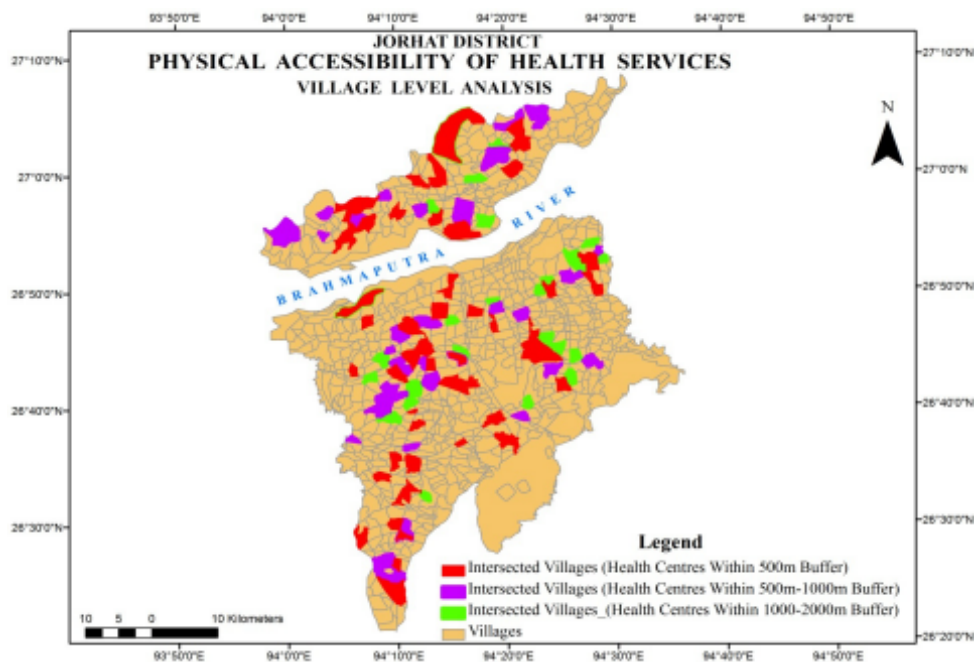
**Fig. 7 :** Intersected Villages with the Health Centres within 500m from the Road Network, Jorhat district, Assam

Again *figure- 8* shows the 500m to 1000m buffer from the major road and the health centres located within this area. The villages marked with the green colour have higher accessibility to health centres within the buffer 500 to 1000m.

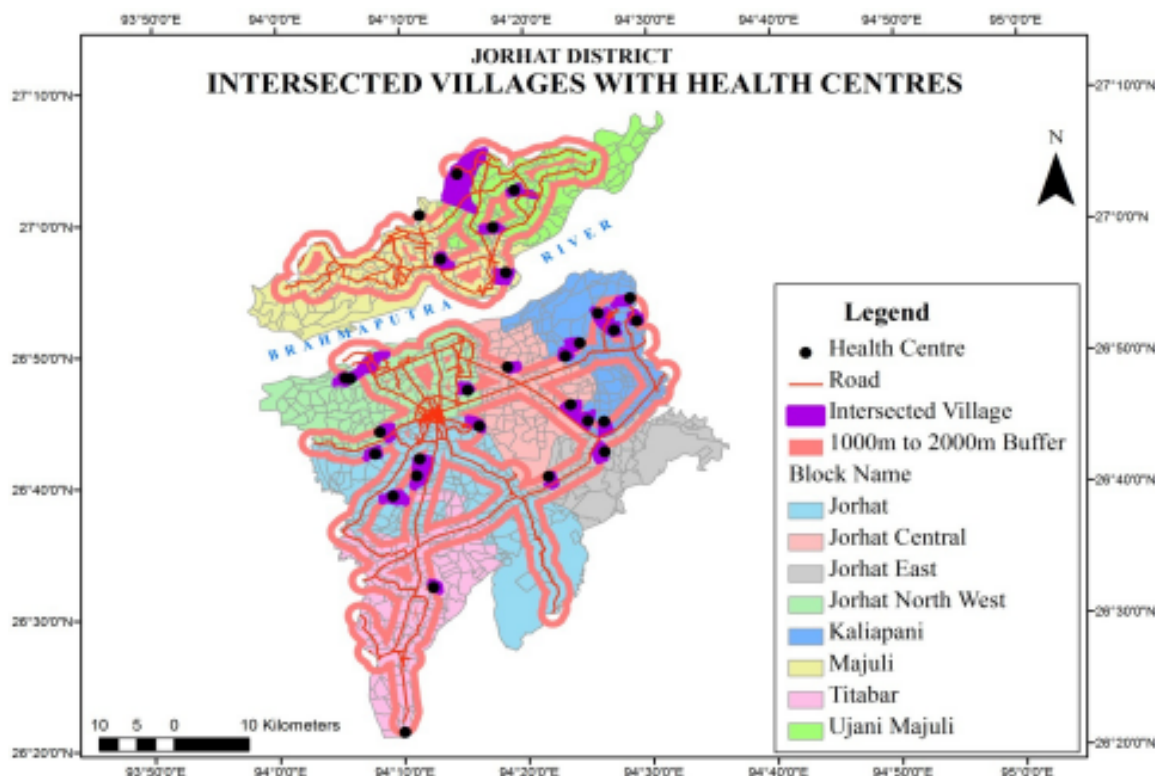


**Fig. 8 :** Intersected Villages with the Health Centres within 500m to 1000m from the Road Network, Jorhat district, Assam

*Figure 9* shows 1000m to 2000m buffer from the major road network and health centres located within this area. In the *figure9* purple colour indicates the intersected villages with the health centres which are within 1000m-2000m buffer from the road network.



**Fig. 9 :** Intersected Villages with the Health Centres within 1000m to 2000m from the Road Network, Jorhat district, Assam



**Fig. 10 :** Intersected Villages with the Health Centres within 500m, 500-1000m and 1000m to 2000m from the Road Network, Jorhat district, Assam

Finally, figure 10 shows the all intersected villages with the health centres which are within 500m, 500m-1000m, 1000m-2000m buffer from the road network. These villages can easily avail health facilities than the other villages in the Jorhat district.

## 7. Summary and conclusion

From the above analysis it is found that within the eight development blocks of Jorhat district the distribution of health services is uneven. It is observed that three blocks i.e. Titabar, North-West Jorhat and Jorhat development block have the highest health centres including primary, sub-centre, and community health centres. In these blocks most of the health centres are located within a distance of 500m from the major roads.

On the other hand physical accessibility is high mainly in town areas of Jorhat district. It is also found that only 13% area falls under the best accessibility zone and 55% area falls under poor accessibility zone which is highest among the three zones. Again only some villages can easily avail the health services. But there are lots of other villages which are still deprived from the services in terms of distance and transportation. Moreover accessibility to health centres in terms of road network does not necessarily mean easy access for villagers rather; health centres away from the main roads may serve the remote areas better. The quality and reliability of health care in the nearest health centres determine the willingness of the people to avail those services.

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