

# Application of Geoinformatics in Pattern Analysis of Seditious Activity in Purulia District of West Bengal in relation to its Geographical and Socio-economic Background.

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**Abstract-** A number of districts of different states (Jharkhand state as well as adjacent parts of Odisha, West Bengal, Bihar and Chhattisgarh) in India are affected by extremist movement in which Purulia district of West Bengal is important one where they claim to be fighting for the rights of the tribes in the forest belt. The group has tried to draw attention through committing several grisly murders, blowing up schools and railway tracks by triggering some explosions. They are engaged seditious activities in the remote and relatively inaccessible places of the district. In the remote areas, they are able to convince the poor, illiterate or less educated people for supporting them and blaming the administration for their under development. A careful geospatial investigation reveals that those blocks which are located very close to the Ayodhya Hill are more affected by the extremist activities (e.g. Balarampur-I, Arsha, Bagmundi Bundwan and Jhalda-I). It is very clear that the activities occurred near the hilly areas and in inaccessible terrain.

**Index Terms:** Geographic profiling, Socio-economic development, GIS.

## 1. INTRODUCTION

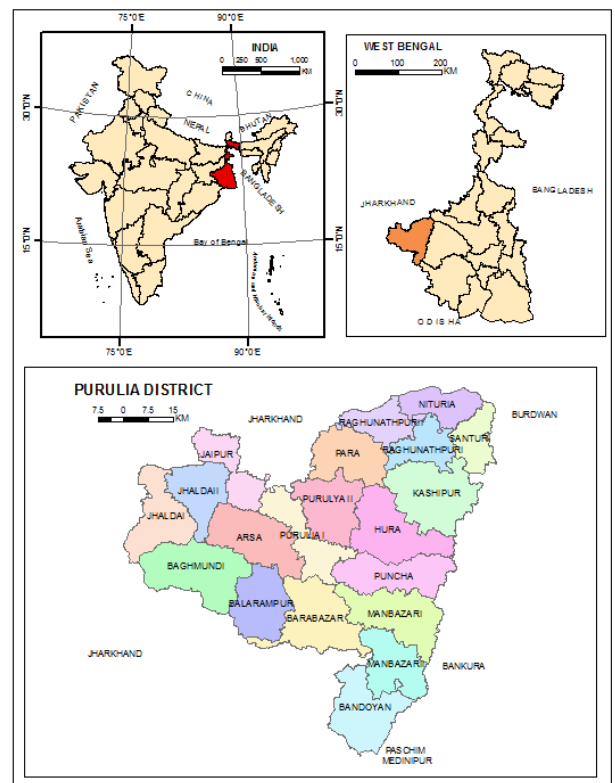
### Purulia District Overview

Purulia district, an integral part of Chhotanagpur plateau, is situated in the western part of West Bengal. It is present between  $22^{\circ} 42'$  and  $23^{\circ} 42'$  in north latitude and  $85^{\circ} 49'$  and  $86^{\circ} 54'$  in east longitude. The geographical area of the district is 6259 sq. km. The Bay of Bengal and the Hugli estuary are within 220 km from the centre of the district

The district headquarter is situated in Purulia town itself having three administrative sub – divisions and two agricultural sub – divisions having Headquarter one at Purulia town and another one at Raghunathpur. At present the district comprises 20 Community Development Blocks, 170 Gram Panchayats, 2,683 Mouzas.

## 2. OBJECTIVE

The presents work is progressed with the following objectives,



- To find out how the geographical background supports the LWE for their activity in the district of Purulia
- To find out which blocks are mostly effected by the LWE activities
- To find out what types of incidents happened in the different blocks in the district
- Finally, draw Geographical Profile of Seditious Activity in the study area

## 3. METHODOLOGY

- In this paper I use the modern technique of GEOINFORMATICS (Remote Sensing, GIS and GPS.) have been used .

- Land use land cover mapping, using satellite imagery (IRS LISS-III) collected from NRSC, will be classified to detect the Land use land cover features.
- Road network mapping using Topographical Sheets from Survey of India and satellite imagery (IRS LISS-III).
- Preparation of the Digital Elevation / Terrain Model (DEM / DTM)
- Spatial database created on last ten years extremist movements and terrorist attacks to identify the spatial pattern, association and causes of vulnerability of the hot spots.
- Locating Potential Hot Spots. Thematic maps could be used to predict likely sensitive points/areas and the infrastructure available to deal with any crisis in those areas.
- Geographic profiling is an information management system and investigative methodology that evaluates the locations of connected serial crimes to determine the most probable area of offender residence.

#### 4. ABOUT THE STUDY AREA

Purulia has its boundaries on the east with the Medinipur and Bankura Districts of West Bengal, in the North with the Burdwan district of West Bengal and the Dhanbad district of Jharkhand, on the north-west, west and south-west with the Hazaribagh, Ranchi and Singhbhum District of Jharkhand. Apart of the northern boundary runs through the centre of the Panchet reservoir so that its water shared by the Dhanbad and Purulia. Similarly, the Eastern boundary runs partly through the centre of the Kangsabati reservoir.

##### 4.1 Topography & Relief

According to the structure and land form, Purulia is a part of the Ranchi Penplains. The 300 Meter contour line is the dividing line between the higher penplains of Jhalda, Arsha, Baghmundi, Balarampur, Barabazar and Bundwan thanas and the lower undulating plains of the rest of the district. The highlands rise very steeply from 600 meters but the slope becomes moderate above 500 meters; there appears an uplift penplains surface.

Ajodhya pahar is the main highland region of Purulia. It acts as a watershed between the Kasai and Subarnarekha. Numerous small streams drain its western and southern slopes into the Subarnarekha and the northern and eastern slopes into the Kasai and Kumari. To the west and south of Ajodhya Pahar occur a number of residual hills, isolated and detached from the parent body.

4.2 Geology:- The district embraces diverse groups of rocks of various geological ages ranging from Archaean to recent viz. The Chotonagpur Gneissic complex covers most parts of the district. Plutonic Gabbro and an orthositic rocks, meta-sedimentaries and meta basics of Singhbhum groups Dalma group

of basic volcanic rocks, Intrusive granites. The Gondwana group has sedimentary with coal seam and quaternary sedimentary as in an order of decreasing antiquity. There are two shared zone  
a) South Purulia share zone –WNW-ESE trending tectonically

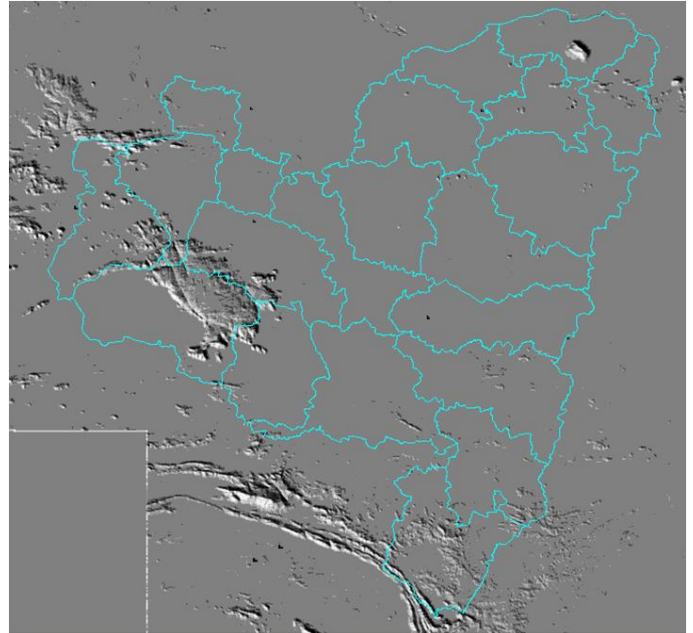


Figure 02 : 3D Topography view of Purulia District  
disturbed share zone. b) North Purulia share zone .

4.3 Climate:- The climate of the area is characterized by hot summer and well distributed seasonal rainfall. The year may be divided into four seasons. The cold season starts by about the middle of November and continues till the end of February. The hot season which extends up to May. The southwestern monsoon season continues the end of September, October and the first day of November constitute the past monsoon season.

4.4 Temperature:- Temperature rises rapidly about from early March. May is the hottest month with a mean delay temp. 35.6°C. On exceptional day of May and June day temp rise up to 42°C. January is the coldest month the maximum temp of 25.3°C and minimum 12.4°C. During the assuage of western distribution areas the north India a cold weather is experienced with a minimum temp of 5°-6°C at night. From November to mid-February the days are quite pleasant but the nights are cold so an extremity temp is found. Rainfall. The average annual rainfall 1300mm the cold and hot weather raise are very light. The annual rainfall about 85% of Rainfall occurs during June to September constitute. August is the wettest month of the year.

4.5 Relative humidity:- Relative humidity is high during the monsoon season being generally between 75%-85% after the withdraw of south-west monsoon relative humidity decreases gradually. During the hot season, the dissent part of the year it stays between 25-35%.

**4.6 Natural Vegetation:-** The natural vegetation of the area under study like Purulia district as a whole is an arboreal type. The hilly part of the study area is still now under forest coverage. The large gregarious, Sal is the most predominant forest tree. There are two varieties of sal the most prevalent, having dark brown heart wood while that the Dom sal, of the lower hills so white slightly tinged with red. Other than Sal Muchkunda a tall evergreen tree, the tall and shady Shimul and Palash is also found. Mauha is also an important tree of this region. In the wood land there is the thick cover of greens and other a layer of shrubs beneath the level of the forest foliage depending on the subtle variation. There is also a protected forest called Matha protected forest covers the Matha pahar between Kestobazar and Kathlajal through forest cover has, however, being cleared and degraded or replaced by shrubs, bushes, and cultivated fields at the foot hill plains. It was indeed a part of the jungle mahal, a land of tropical deciduous forest due to biotic interference such as shifting cultivation, fire, graze ring and also unscientific forest management. Such interference has affected the flora of the district either by checking the progress of vegetation to the higher succession stage or by bringing about a retrogression.

**4.7 Soil Type:-**

The soil type of the area under study may be devised into two main categories- a)The laterite soil of the hilly area, this own its origin to the hot and humid climate associated with an alternate period of the wet and dry season. These are residual soil, formed of the bed rock of granite and gneiss. Decomposed and designated rocks have formed. The soil and their rem in-situ, Geological their soil are older but immature compared to the alluvium of the foot hill area. Ecological they are however old enough to support plants. When under the forest canopy, sheltered from direct exposure to erosion the soil get enriched by chemical decomposition of present materials and organic matter and develop into natural soil. But as soon the vegetation cover is removed the soil is severely depleted by mechanical weathering and erosion. These soils are mostly developed from gneiss. They are usually very shallow, well drained, gravelly, loamy to the gravelly loamy surface they developed as a result of leaching of calcium from upper horizon due to heavy and concentration of iron calcium at or near the surface of the soil. The colour of the soil varies from light red to brown depending on the minerals matter. Only in the river bed, there is the concentration of fine loamy of darker. In Purulia the soil is lightly textured with high porosity and poor water holding capacity. It is slightly acidic in reaction (pH 5.5 to 7.2) having less of organic matter as well as major nutrients like N, P and K. Due to continuous erosion of soil, micronutrient deficiency is common in upland and medium high land situation. In the district of Purulia more than 24000 ha of land have been converted to culture able wasteland

**5. THE BLOCKS AFFECTED BY THE LWE ACTIVITIES**

As I stated earlier that the Ajodhya hill forms the main highland region of Purulia and covered by dense forest and the west and south of Ajodhya Pahar occur a number of residual hills, isolated and detached from the parent body, for this, the members of

LWE hill is by the LWE for their main shelter. The nearest blocks of the hill like Balarampur, Baghmundi, Arsha, Bundwan, Jhalda were affected by the LWE activities.

Source: Supdt. of Police Office, Purulia & <http://policewb.gov.in/>

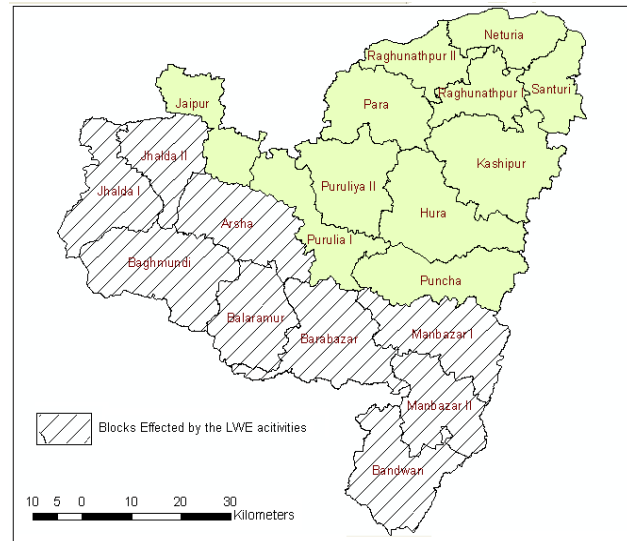


Figure 03: LWE activities places of Purulia District.

**6. ROAD NETWORK**

The road transport network is almost adequate in terms of availability of bus and flow of goods carriage. National Highway 32 connects this district with Jamshedpur, Bokaro, Chas and Dhanbad. National Highway 60A connects Purulia with National Highway 2. State Highway 2 and State Highway 4 also plays important role in district's transport network. Purulia has also excellent road connectivity with Raniganj-Asansol industrial belt

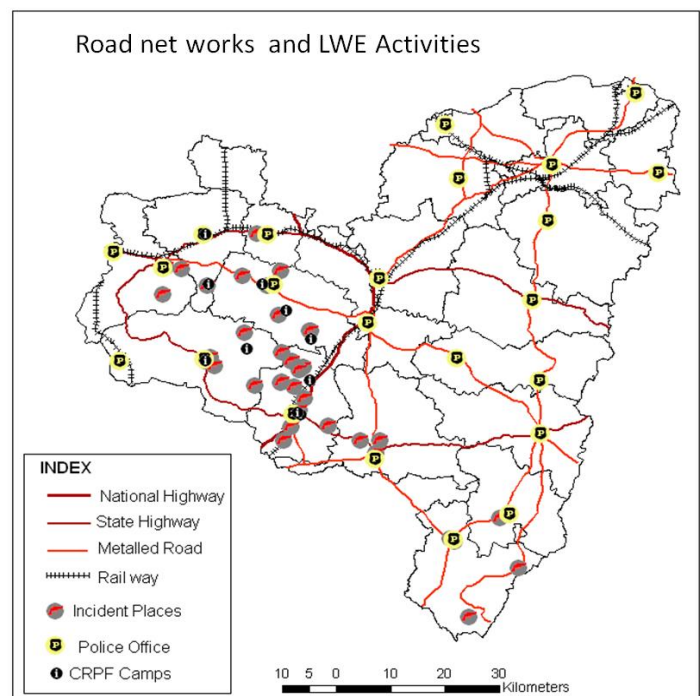


Figure 04: LWE activities places and road networks of Purulia District.

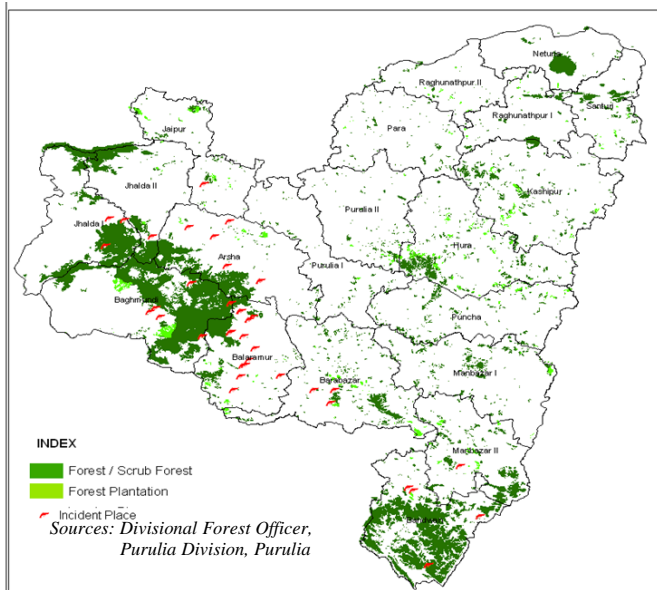


### 6.1 Railways

The District is served by 3 Rail connections provided by the S.E.R. One Line runs from Jharkhand State in the South through the District up to Asansol passing through Adra. Another Line runs between Bankura and Dhanbad via Adra. The third one connects Jhalda to Chas in Jharkhand. Major cities and towns like Ranchi, Tatanagar, Patna, Howrah, Dhanbad, Asansol, Bhubaneswar, Delhi, Mumbai, and Chennai etc. are now connected with Purulia by direct mail/express trains

### 7. FOREST COVERED AREA

Total forest coverage in this district including social forestry and degraded forest as per Satellite Imagery (IRS LISS IV - 2009) data is 185726 ha which is 29.69 % of the total land of the district. The natural forests of the district are mostly of mixed nature and restricted to northwest part of the district covering Ajodhya Hills and Panchet hills of northeast.



- The areas are bounded by Ranchi and Hazaribag districts of Jharkhand in West and Singhbhum district of Jharkhand in South and Bokaro & Hazaribag Districts of Jharkhand North respectively.
- Jurisdiction spreads over 6 administrative Blocks of Purulia District, namely – Balarampur, Bagmundi, Jhalda-I, Jhalda-II, Arsha & Joypur.
- Mostly coppice Sal forest mixed with misc. species like Palash, Kusum, Mahua, Neem, Kend. The major source for timber, pole, small wood, NTFP, firewood, medicinal plant to local people.

### 8. POPULATION DENSITY

In 2011, Purulia had population of 2,930,115 of which male and female were 1,496,996 and 1,433,119 respectively. In 2001 census, Purulia had a population of 2,536,516 of which males were 1,298,078 and remaining 1,238,438 were females. Purulia District population constituted 3.21 percent of total

Maharashtra population. In 2001 census, this figure for Purulia District was at 3.16 percent of Maharashtra population.

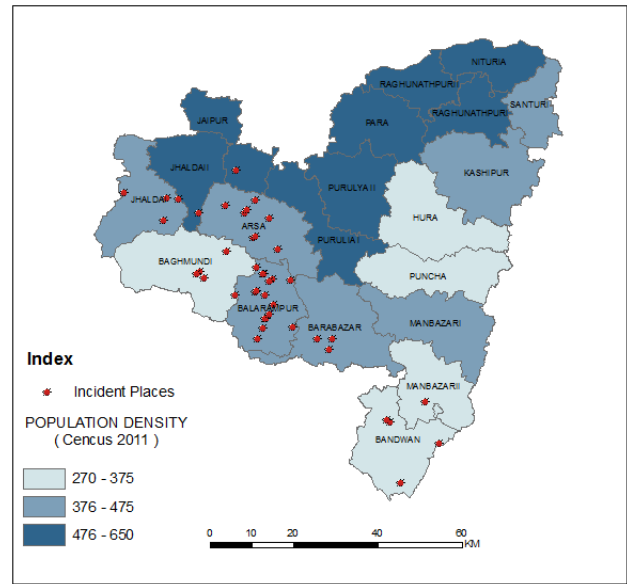


Figure 06 : LWE activities places with Population Density of Purulia District.

The initial provisional data released by census India 2011, shows that density of Purulia district for 2011 is 468 people per sq. km. In 2001, Purulia district density was at 405 people per sq. km. Purulia district administers 6,259 square kilometers of areas.

Table 1: Population Density (Block wise)

BLOCK NAME	POPULATION DENSITY	BLOCK NAME	POPULATION DENSITY
Arsha	412	Manbazar I	404
Baghmundi	317	Manbazar II	339
Balarampur	458	Neturia	533
Bandwan	270	Para	642
Barabazar	407	Puncha	375
Hura	375	Purulia I	537
Jaipur	595	Purulia II	547
Jhalda I	435	Raghunathpur I	583
Jhalda II	577	Raghunathpur II	576
Kashipur	443	Santuri	437

Source : Census 2011

### 9. PURULIA LITERACY RATE

Average literacy rate of Purulia in 2011 were 64.48 compared to 55.57 of 2001. If things are looked out at gender wise, male and female literacy were 77.86 and 50.52 respectively. For 2001 census, same figures stood at 73.72 and 36.50 in Purulia District. Total literate in Purulia District were 1,624,905 of which male and female were 1,002,058 and 622,847 respectively. In 2001, Purulia District had 1,182,284 in its district.

has been increased from 7.8 % in 1991 to 19.03 % in 2001 census. Cultivators have been shifted to other working classes.

**Table 3 : Occupation Distribution of Different Years**

	1991 Census	2001 Census	2011 Census
1. Main Worker	7,86,425	6,44,748	6,13,398
A. Cultivators	3,89,186	3,52,104	1,66,814
B. Agri-Labours	2,00,205	4,06,835	1,28,475
C. H.H. Industry	21,768	83,633	45,114
D. Other Workers	1,75,266	2,84,584	2,72,995
2. Marginal Workers	1,73,539	4,82,408	6,36,244
3. Non Workers	12,64,613	14,08,077	1,68,0473

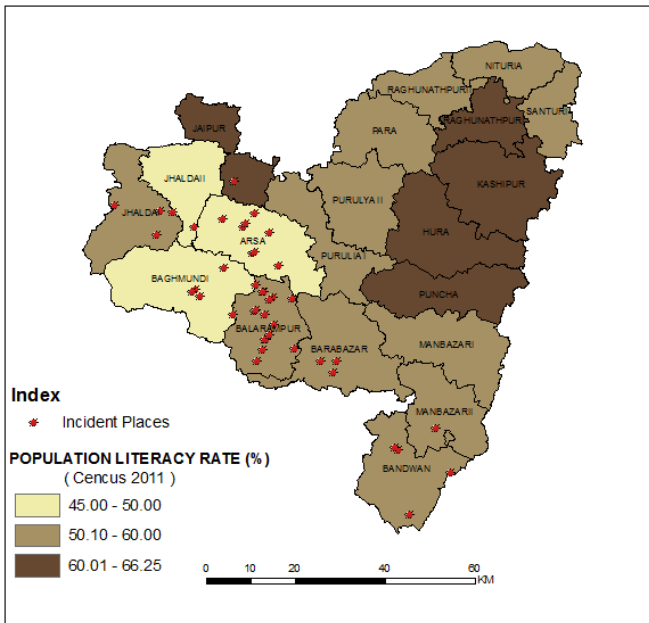


Figure 07 : LWE activities places with Literacy Rate of Purulia Dist.

**Table 2: Literacy Rate Variation**

Literacy Statistics	2001	2011
Total Literacy Rate (excluding 0-6 population)	55.57	65.38
Male Literacy Rate (excluding 0-6 population)	73.72	78.85
Female Literacy Rate (excluding 0-6 population)	36.50	51.29
Literacy Rate in Urban Areas	75.40	76.24
Male Literacy Rate in Urban Areas	85.03	84.68
Female Literacy Rate in Urban Areas	64.91	67.21
Literacy Rate in Rural Areas	53.24	63.75
Male Literacy Rate in Rural Areas	72.37	77.96
Female Literacy Rate in Rural Areas	33.24	48.93

The district has a population of 2,930,115 (as per the 2011 census) Out of which 19.35% is S.C. and 19.22% is S T.

- The literacy rates of male and female are 77.86% and 50.52 % of the total population.
- Total no of BPL families in rural areas of this district are 197381 (43.65 %). Out of which SC families are 40645 (20.59 %) and ST families are 47666 (24.15 %)
- About 90 % of the population lives in villages and about 44 % of the rural population is below poverty line

**10. OCCUPATION DISTRIBUTION**

The main working class has been decreased from 35.35 % in 1991 to 25.43 % in 2001 census whereas Marginal working class

**10. RESULT AND DISCUSSION**

Spatial information on last ten years (2001-2010) extremist movements was collected from daily newspapers and their respective websites; crime records from the office of the Superintendent of Police - Purulia; and primary survey in local political offices and forest villages. Data were plotted on the base map as the point layer. Analyzing the spatial pattern of last ten years extremist movements (i.e. attacking police camps and police vehicles with grenades and landmines and conducting guerrilla warfare inside the forests; taking hostages and assassinating local political leaders in the dark; arson and

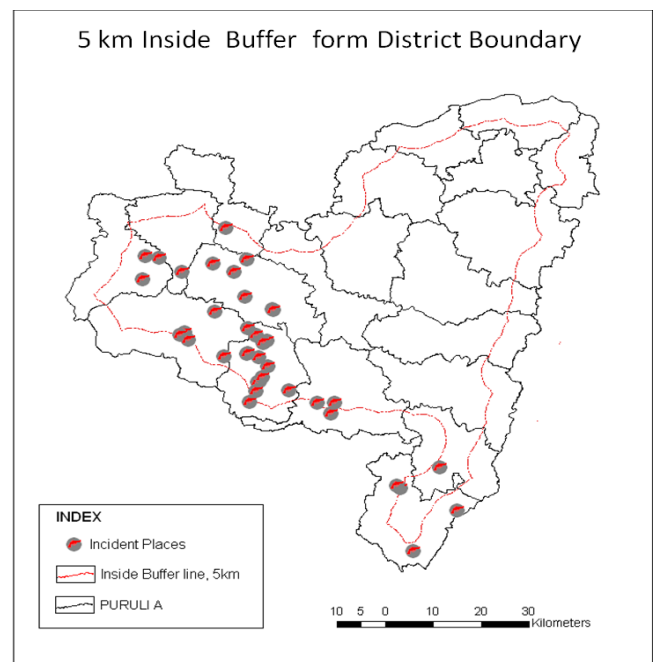


Figure 08 : LWE activities places of Purulia District

blasting on railway tracks; abduction for ransom and running extortion racket etc.), mainly three (3) hot spots are identified:

- i) Balarampur Town, along the Purulia Chandil Road. Here all incidents happened not far away from this main road
- ii) Ghatbera-Kerwa zone where seditious activities are clustered within three villages.
- iii) Ajodhya More, here most of the cases happened along the main road near Bagmundi town

Surprisingly most of the incidents occurred within five km radius from the police camps and in some cases on the police camps. The border line of Jharkhand State is not more than ten km from any part of these regions thus after operation escape is trouble-free

Geographic profiling helps to organize an abundance of information via geographical links in order to accelerate the apprehension process. While geographic profiling is an effective tool to hit upon the most probable residence of the offender, it cannot “solve” cases. Geographic profiling enables crime Geographical analysis highlights the crime location, any physical boundaries that were present (that might not otherwise be noticed), and the types of roads and highways that come into both the abduction and body dump sites. It can also track the routine activity of the victims, because people tend to stick with familiar territory. That means that an analysis of all the crime scenes could provide clues about where an offender lives.

GIS can be used to produce thematic maps on any of the above parameters enumerated and these can provide analysts with clues to patterns of crimes. A thematic map with age of victims as a criterion, for instance, will quickly present the officers with specific areas highlighted in different colours for different age groups

## 11. CONCLUSION

Digitized maps using specific overlays could provide immense decision-making tools to collect and analyses information comprehensively. LW Extremist prefers Jungle Areas for their shelter and their activities mainly border areas of western part of the district. They are utilizing the forest and road side areas for materializing and implementing their plant/vested interest. They are luring the innocent and poor people and there by attracting them to promote their activities. In spite of many attempts taken by the central or state government for social and economic reform of the region, no action plan has become totally successful because of lack of spatial information and finding of the proper solution. This study will be capable of with highly scientific and contemporary methodologies with reliable satellite data products. Geographical Information System (GIS) has already proven to be a successful means in the field of ‘Ecotourism Planning’ and GIS application also has relevance in spatial analysis of crime and terrorist movements. It is suggested that, Socio-economic and ecotourism development shall be the key to solving the problem, identifying the potential sites for tourism based on locally available natural resources.

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