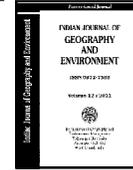


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## Ecotourism development and Security Restructuring Based on 'Hot Spot Analysis' and 'Geographical Profiling' of Seditious Activities in Jungle Mahals of West Bengal

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### KEY WORDS

GIS  
Ecotourism Planning  
Security Restructuring  
Anarchism Dissuasion  
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### ABSTRACT

Ajodhya Hill in Purulia district of West Bengal is a treasure house of natural beauties, but hilly terrain and thick forest cover have made many parts of this region inaccessible by road and perpetual agricultural drought over decades had weakened the economy of the area. Taking advantage of this physical and economic handicap, an organized group of social and political activists called Left-Wing Extremists (LWE), perpetrating violence and keeping the people of this region under threat. Non-cooperation of local population being the prime obstacle, government security forces with all its intelligence network and muscle power had not been utterly succeed to stop these activities.

This UGC (University Grant Commission - Govt. of India) sponsored 'Minor Research Project' plans for economic and social stabilization of this region through the promotion of alternate economic practices for underprivileged forest dwellers and involving them in anti-terrorism operations. Taking into account the severity of physical environment and minimum skill level of tribal people, implementation of 'Ecotourism' in these forest villages seems to be the best income-generating activity and ecologically permissible too. Due to essentially spatially distributed nature of tourism and terrorism related data and need of various types of spatial and statistical analysis GIS has proven to be a successful means in this study and based on spatial, non-spatial and attribute data overlay ('Weighted Sum Overlay Analysis'- ARC-GIS 9.2), ecotourism potential zones were identified. The inputs in the form of arc-coverages were assigned relative weightages according to their influence/importance in ecotourism development. Cadastral level action plan maps have been prepared for ecotourism infrastructure development and sustainable land use practices. 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. Lastly spatial decisions have been made for allocation and relocation of police out posts, military camps and local participatory groups for fast information transfer and rapid action against any kind of social disorder.

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## 1. Introduction

In contemporary world extremist movements and terrorism are the biggest threat to the human civilization. In most of the cases the birthplace of these extremist groups are the most backward and inaccessible part of a nation, where physical austerity has impeded the development of agriculture, industry and transport network and made the region economically and socially backward. Thus poverty and ignorance among local population sometimes help the extremist groups to prosper more rapidly and effectively. To get the support and involvement of the local people in anti-terrorism operations, the administration first should strive to alleviate poverty of the region by arranging income-generating programs. Economic uplift automatically brings social awareness, and people spontaneously act against any kind of anarchism, which may come across the way of their earnings.

The forest provinces of Indian Plateau are full of natural attractions but the physical environment of this region is not suitable for intensive agriculture. The unskilled tribal people of these regions are also not preferred by the modern industry. Thus considering their low skill level as well as the environmental regulations, implementation of 'ecotourism' in forest villages may be the most suitable income-generating activity. Since 'ecotourism' has been defined by the Ecotourism Society in 1992 as "purposeful travel to natural areas to understand the cultural and natural history of the environment, not altering the integrity of the ecosystem, while producing economic opportunities that make the conservation of natural resources financially beneficial to local citizens" (Panda et al, 2004). The volume of manpower could be engaged in tourism related activities is one of the highest in the service sector, which can create a wide range of job opportunities for millions of people with minimum skill level.

## 2. Study Area

Ajodhya Hill ( $23^{\circ}05'32''\text{N}$ - $23^{\circ}20'30''\text{N}$ ,  $85^{\circ}55'00''\text{E}$ - $86^{\circ}14'20''\text{E}$ ) in Purulia District of West Bengal is a part of the 'Jungle Mahals', i.e. tropical dry deciduous forest of Chotonagpur Plateau Region and mostly inhabited by tribal population. 176 Mauzas (villages) of Jhalda-I, Jhalda-II, Arsa, Baghmundi and Balarampur Block of Purulia share the 408.53 sq.km hilly tracts of Ajodhya (Fig-1). Undulating topography and dense forest cover of this region are responsible for its surface inaccessibility and thus lacking in medical and educational facilities. Though the climate

of this region is not very harsh (annual average rain fall is 1286 mm, with annual mean temperature  $26^{\circ}\text{C}$ ) but infertile laterite soil (originated from granite-gneiss of oldest precambrian or archean formations) with high evaporation and infiltration losses caused agricultural drought, which accumulated over years and had damaged the economy of the area. In "Integrated Mission for Sustainable Development"-1993 Govt of India identified 152 districts of India as backward district, and Purulia District was one of them (Anonymous, 1996). Making use of this physical and economic constrain, an organized group of social and political activists called Left-Wing Extremists (LWE), compelling local people to take part in their anti government insurgency. Left-Wing Extremism (LWE) was described by Chief Minister Buddhadev Bhattacharjee in 2005 as "plagued by the collapse or absence of rural governance" (Prasad, 2008).

Aside these socioeconomic hostilities, Ajodhya Hill is blessed with natural marvels. It has a blend of steep mountains, splendid waterfalls, dense forests with her wildlife beauties and huge water bodies (reservoirs). In the year 2006 Ajodhya hills has been declared as "Conservation Reserve" at state level by the State Wildlife Board (Anonymous, 2006). There is a huge potentiality of development of ecotourism in this 'only hill station' of South Bengal but inadequate infrastructure for transportation and accommodation, and dominance of Left-Wing Extremists (LWE) in Purulia district, have made this region lagging behind other tourist destination of South Bengal.

## 3. Objectives:

Planning for ecotourism development and security restructuring as the sole objective, the present study is undertaken with the following intents :

- i) Study the present physical and socioeconomic condition of Ajodhya Hill along with existing tourist spots, tourism infrastructure and annual tourist flow.
- ii) Identification of potential ecotourism sites in the study area based on spatial, non-spatial and attribute data analysis.
- iii) Creation of spatial database on extremist movements and terrorist attacks in last ten years to identify the spatial pattern, association and causes of vulnerability of the hot spots and to make an inventory of existing government security infrastructure to assess their positional accuracy and adequacy in combating terrorism.
- iv) Planning for direct involvement of the local the people in the tourism sector and spatial decision making on allocation and relocation of police out

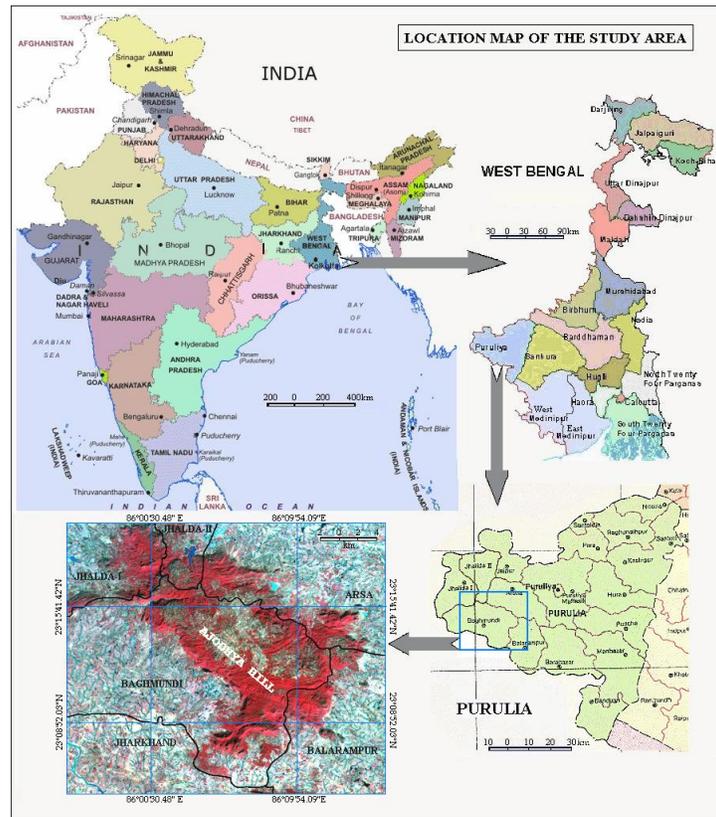


Figure-1 : Location map of the study area consisting of 176 Mauzas (villages) of Jhalda-I, Jhalda-II, Arsa, Baghmundi and Balarampur Block of Purulia District, West Bengal, India

posts, military camps and self-protection groups to have an administrative control over the entire region. v) Generation of cadastral level action plan maps for ecotourism infrastructure and security infrastructure development as well as sustainable land use practices.

#### 4. Methodology:

Due to essentially spatially distributed nature of tourism and terrorism related data and need of various types of spatial and statistical analysis, GIS applications have a great relevance in this study.

Keeping in mind the basic thirsts of an ecotourist, *ecotourism potential* ( $E_p$ ) sites were selected based on nine criteria: high *elevation* (El) and high *relative relief* (Rr), dense to moderate *forest cover* (Vd), proximity to *water bodies* (Wb), waste land or forest-fringes as desired *land use* (Lu) very low *population density* (Pd), *road connectivity* (Rc), *food and lodging facilities* (Fl) and minimum 20 hectares *level ground* (Lg) for ecotourism infrastructure development.

Mathematically, this can be expressed as:

$$E_p = f(Rr, El, Vd, Wb, Lu, Pd, Rc, Fl, Lg)$$

These criterions were taken as the parameters to evaluate the areas of high ecotourism potential (Fig-2). For this purpose a 'Weighted Sum Overlay Analysis' method was adopted (Stewan and Peter, 2002). The input in the form of ARC/GIS coverage were assigned relative weightage in accordance to their influence/importance in decision-making based on expert opinion and each class in the individual coverage were ranked from 10 to 1 according to its potential of being or for being developed for ecotourism (Table-1).

In this context we can say

$$E_p = \sum W_i CV_i \quad [\sum W_i = 100]$$

Where  $E_p$  is ecotourism potential map value,  $W_i$  is the significance value of each theme that is theme weight and  $CV_i$  is the grade value of individual class of a particular theme that is class weight.

Assigning the theme weigh, the above equation can be written as:

$$E_p = (27^*CVRr) + (20^*CVWb) + (17^*CVLu) + (14^*CVEl) + (13^*CVPd) + (9^*CVRc)$$

SI No.	1		2		3		4		5		6	
Theme Layer	Relative Relief		Distance from Water Body (Water Body Buffer zones)		Land Use		Absolute Relief		Population Density		Distance from Motorable Roads (Road Buffer Zones)	
Theme weight (%)	27		20		17		14		13		9	
Classes With Class weight (1-10)	>120m	10	<1km	10	Open Forest	10	>470m	9	<100/sqkm	9	<1 km	8
	80-120m	8	1-2 km	9	Scrub Land	9	220-470m	6	100-200	8	1-2	7
	40-80m	6	2-3 km	7	Dry Fallow	9	<220m	4	200-300	5	2-3	6
	<40m	4	3-4 km	3	Dense Forest	8			300-600	2	3-4	5
			4-5 km	2	Agricultural fallow	2			>600/sqkm	1	4-5	4
		>5km	1	Others	1					>5 km	3	

Figure-1 : Theme weight and class weight of respective theme layers assigned according to their influence/importance in ecotourism development.

Spatial information on last ten years extremist movements were 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 point layer. Probable routes of LWE operation were detected by examining the pattern of occurrences of crime and relating them with the land use / land cover information. Location of police stations, police out posts, paramilitary camps and their jurisdiction area were also plotted on the base map to determine their

positional accuracy and adequacy in combating seditious activities. Zones of concentration of extremist incidents were used to predict likely sensitive points/areas (hotspots) and the causes of their vulnerability were analyzed from 'Geographical Profiling of Crime' (Krish, 2003) and 'Proximity Analysis' from security camps, motorable roads, and state border line. Lastly an action plan has been prepared on ecotourism infrastructure development, allocation and relocation of police out posts and paramilitary camps; and creation of self protection groups to support local law enforcement agencies.

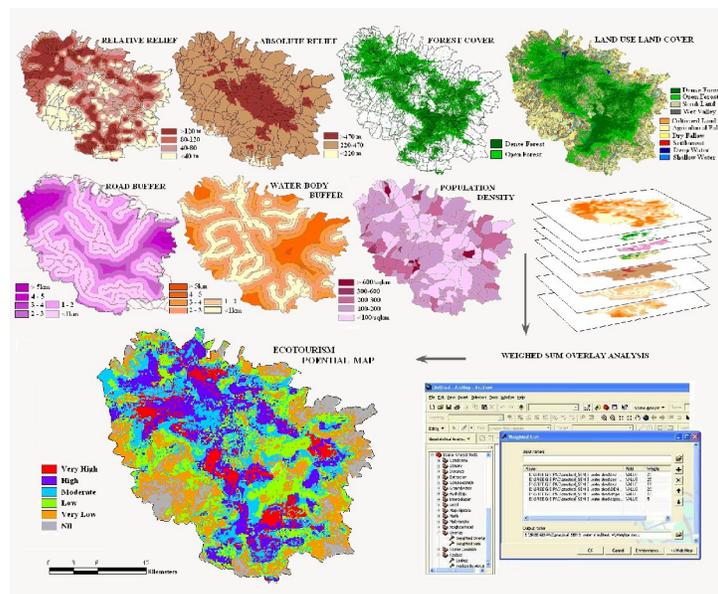


Figure-2 : Ecotourism potential zone identification by "Weighted Sum Overlay Analysis" of different thematic layers (e.g. absolute relief, relative relief, forest cover, land use land cover, road buffer, water body buffer, population density etc.)

### 5. Result and Discussion:

Annual tourist influx in Ajodhya is much lower than the other tourist spots of South Bengal but the positive aspect was, a steep increase in tourist flow observed each year from 2001 to 2006. Construction of Purulia Pumped Storage Project (PPSP), the engineering marvel, was the main attraction. From 2001 to 2002 tourist flow increased 363%; in 2003 it increased 47%; the increase was low from 2003 to 2004 only 10%; but in 2005 it was 125%; and another 65% more tourists visited the place in the year 2006. Tourist flow was in its peak during 2007. 89026 persons including 634 foreigners visited Ajodhya Hill this year, but due to ever increasing LWE activities from 2008 tourist flow gradually decreased each year and in 2009 it came down to 80245 persons only (Anonymous, 2010).

From 'Weighted Sum Overlay Analysis' seven (7) spots on the hill are recognized as appropriate for ecotourism development (Fig-3). They are named as Zone-A (Dulgubera - Purna Tanrpania), Zone-B (Bandhghutu - Bidyajara), Zone-C (Ajodhya - Kuchrirkha), Zone-D (Kamarjara -Goberia), Zone-E (Dhanchatani-Lukuchatani), Zone-F (Bamni-Lakshmipur) and Zone-G (Inchakata-Burda). It is noteworthy that out of seven zones, Zone A, B, C, D, G are inside Baghmundi block, Zone-E in the boarder of Balarampur and Arsa Block and Zone-F in the boarder of Arsa and Jhalda Block. Cadastral level action plan maps have been prepared for sustainable

land use practices and ecotourism infrastructure development. Ecotourism infrastructure involves tourist cottages/rest houses, green hotels and restaurant, public convenience facilities, elephant watchtower, tourist information centre, conveyance facilities, tourist guide map, public convenience facilities, detail map of the ecotourism destination, tourist circuit map to show its link to other place of tourist interest, do and don't board, medical aid facilities, communication facilities etc. (Benerjee et al, 2002). Strategies related to 'Participatory Forest Management' and 'Community Tourism' are proposed to involve local people in ecotourism planning and management (Obadih, 1999). "Environmental Approach" (De and Jana, 1994) was adopted for sustainable land use planning. Proposals are given on what are the areas should be afforested immediately, where expansion of settlement and cultivation should be restricted, instead of large-scale cultivation, thrust area will be forestry and forest based economic activities like agro-forestry, horticulture, floriculture, sericulture, aquaculture, horticulture, animal husbandry etc. The yields will meet the demand of tourists as well as the local people.

Analyzing the spatial pattern of last ten years (2001-2010) 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

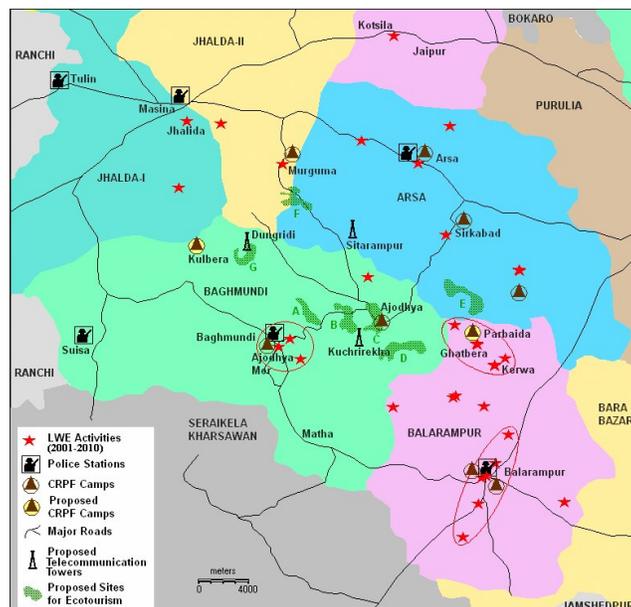


Figure-3 : Proposed sites for ecotourism development, LWE activities hotspots and government security infrastructure in and around Ajodhya Hill.

political leaders in the dark; arson and 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 and we can see a linear pattern of occurrences. 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 (Fig-3). 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. Cross border forest tracks and gullies revealed from high resolution IKONOS data (GCR-1.0m) closely matches with their routes of operations.

At present there are six (6) Police Stations, eight (8) CRPF Camps and one (1) Traffic Out Post / Check Post in and around Ajodhya Hill. But two strategically important points, Kulbera river dam near Zone -G and Parbaida near Zone-E are still unprotected. Therefore two more CRPF cams are required in these points. One Traffic Out Post/Check Post is also necessary at Chak Keryari of Jhalda-I. To bring the entire area under telecommunication network coverage, installation of three new mobile towers (at Kuchhrekha, Dungridih, and Sitarampur village) in 'no-network coverage' areas of Ajodhya Hill have been proposed (Fig-3). It will help in fast information transfer and rapid action of law enforcement agencies. Active role of local administration (e.g. Gram Panchayet) is also solicited in formation of self protection groups among the villagers and involving them in antiterrorism campaigns.

## 6. Conclusion:

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. But this research will be equipped 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, because one of the most invaluable tools available for effective crime fighting is spatial

information. When the action plan will be materialized the downtrodden aborigines of the region will get the maximum benefit and security of the region both in terms financial and administrative means could be ensured. Thus this will be an unique venture, first of its kind in this region showing the way of economic and social transformation based on advanced technological know how. This model also can be applied in other less reproductive, rugged regions of the world where natural limitations are the root of economic, social and political turmoils.

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