

MAPPING AND DOCUMENTATION OF NEWLY EMERGED LANDS IN THE COASTAL AREA OF THE ODISHA STATE, INDIA USING HIGH RESOLUTION REMOTE SENSING DATA AND GIS

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ABSTRACT

Geospatial technology plays a major role in identifying, mapping, characterizing, documenting and displaying newly emerged and submerged lands along the coastal areas for inventorying new land mass for land record updation and many important coastal activities. Their documentation is needed in context of scarcity of land parcels for extension of existing industrial activity, identification of land for Coastal Economic Zone (CEZ), port extension activity, sites for coastal forest regeneration, shoreline changes, identification of unauthorized settlements, anomalous/disputed ownership pattern, nearness to the Coastal Regulation Zones (CRZ), etc. Presently High resolution satellite image coupled with GIS and GPS provides ample scope to demarcate the emerging lands along the coastal regions. The cadastral datasets available from the Government Revenue Department belong to surveyed data of different years. Comparison of high resolution satellite image (World View-II data, period 2014-15 having sub-meter spatial resolution) with the digital cadastral datasets of past years helps in identifying the newly emerged land and the exact status of land cover/land use along the coast. These need to be identified, documented and intimated to the Revenue Department and General Administration Department of the local government so that needful planning on the newly created lands can be taken up. The objectives of the mapping is to identify the newly emerged lands in the coastal area of two local administrative units of the Odisha State using high resolution satellite image and digital georeferenced cadastral database and mapping of the current land cover/land use status along the coast using high resolution satellite image. High resolution satellite image (World View-II, PAN and MX) are georeferenced with available data sets at Odisha Space Applications Centre. The results show that the information generated are helpful in demarcation of newly emerged landforms for implementation of legal rights and local administration.

INTRODUCTION

In recent years, the geospatial technology plays a major role in identifying, mapping, characterizing, documenting and displaying newly emerged and submerged lands along the coastal areas for inventorying new land mass for land record updation and many important coastal activities. Documentation of existing land parcels is needed in context of scarcity of land for extension of existing industrial activity, identification of land for Coastal Economic Zone (CEZ), port extension activity, sites for coastal forest regeneration, shoreline changes, identification of unauthorized settlements, anomalous/disputed ownership pattern, nearness to the Coastal Regulation Zones (CRZ), etc. Presently High resolution satellite images coupled with GIS and GPS provides ample scope to demarcate the emerging lands along the coastal regions. The cadastral datasets available from the Government Revenue Department belong to surveyed data of different years. The Cadastral survey mostly deals with establishment of parcel boundaries of public or private real properties for legal purpose, land ownership, value assessment etc.

Now with advent of high resolution satellite data gathering of cadastral information is now becoming more easier. Besides being used for geo-referencing the satellite data also gives information about the current land use practices which may or may not match with the record of right (ROR) of the revenue survey department data (UN, 2000, Krishnamurthy and Rao, 2010, Cakre, 2016, Hemant Kumar, 2016). The reality of the scenarios are to be recorded for updation of land records and many other purposes. In inaccessible areas the data become a boon for the surveyors to record the scenario. The Odisha coast being a depositional coast formed due to alluvial materials deposited by the intricate river networks in the deltaic region, is seen endowed with lands which are seen submerged in some places forming swales and as well as emerged in developing mudflats, sand cast areas and beach formation. The history was recorded long back and over the years there are lot of changes occurred in the area due to natural and anthropogenic reasons. These changes need to be identified, documented and intimated to the Revenue Department and General Administration Department of the local government so that needful planning on the newly created lands can be taken up. The objectives of the mapping is to identify the newly emerged lands in the coastal area of two local administrative units (Jagatsinghpur and Kendraparha districts) of the State using high resolution satellite image and digital georeferenced cadastral database and mapping of the current land cover/land use status along the coast.

METHODOLOGY

Ortho rectified Cartosat-1 satellite data for entire coast is available under SIS-DP project (a project sponsored by ISRO,Department of Space ,Government of India).The same is being used for geo-referencing of world view-2 data(2014-2015).Cartosat-1 data is preferred because it is more stable and it is not changing the viewing angle and good enough to prepare maps at 1:10,000 scale (Radhadebi,etal 2012).Adequacy of information and geometric fidelity is also established (Rao,2014 and Das ,2015).The cadastral paper maps are scanned ,digitized and geo-referenced with respect to the Worldview images (2014-15). All the historical cadastral dataset i.e 1923-24 to 2014-15 are also geo-referenced and spatially adjusted with respect to the high resolution satellite image. Cadastral dataset is superimposed on high resolution satellite image and newly emerged lands have been captured .Area of land loss and land gain are mapped and shown in Table 1.Major accretion areas are shown in Table-2.

DISCUSSION

The cadastral system always links the boundary property rights. Typical question are : who has the right? Where is the right and what is the type of land use and what restrictions are applied etc.Land issue are generally subject of state. It is vested with the revenue department of the state Government. The records which can be expressed as ground to record and record to ground truthfulness are generally preserved as written records in local / vernacular languages. There is no uniformity in the nomenclature of land parcel adopted in a lower level administration unit cast aside Country level commonality.

At this present juncture, now the central Government of India promulgated one national level project called National Land Records Modernisation Programme (NLRMP) which recognize and directed to adopt and implement high tech survey for modernization of the land records.At present coastal districts of Odisha state are not being undertaken and in future there will be a challenge to have the records in the inaccessible areas.

Cartosat-1 data gives positional record of land units in a manner which could be only used for reference purpose (approximately 10 km accuracy). High resolution satellite data (World view-2) having good spatial resolution supplement the positional accuracy of land parcel to 2-3 meter. After superimposition of the cadastral maps on the image , changes of spatial representation of land parcels are documented . Revised maps have been prepared and area statistics have been generated.Area of land gain/loss are being shown to the revenue official and the importance and utility of the mapping was highlighted . The coast at Kanhupur village in Kendraparha district largely eroding in nature and most sandy habitat of olive ridley sea turtles are endangered by the coastal erosion.Table-1 shows such information district /block/tahasil/village wise .Cadastral plots belonging to government and public lands, temples and forested land have been engulfed by the sea and the same are still mentioned in the revenue records. The coast at Kanhupur village in Kendraparha district largely eroding in nature and most sandy habitat of olive ridley sea turtles are endangered by the coastal erosion. Total land gain and loss and the number of plots are shown as + and – signs. Major accretion areas and there areas are listed in Table-2.These land masses have no mention in RoR and need proper documentation for several legal issues in evacuating people engaged in agriculture ,aquaculture and settlements. Areas where most of

Table.1. Details of Cadastral Land conversion into different Land use/Land cover(LULC)

DIST	Tahasil	Village name	Villa ges	No. of plots	Cadastral type	Present LULC	Area in Acre
KENDRAP ARHA	MAHAKAL PADA	Hetamundai	1	49	forest	mudflat	-1873.84
		Saralikuda	2	6	forest	mudflat	-239.97
				1	river	sea	-224.56
		Jogidhankud	3	5	forest	mudflat	-449.17
				3	forest	river	-579.31
				2	river	mudflat and mangrove	+225.81
		Banapara	4	5	forest	mudflat	-282.58
				1	waste land (patita)	sea	-41.70
				1	waste land (patita)	river	-9.8

			1	waste land (patita)	forest	+21.07	
		Jamboo	5	1	river	mudflat and mangrove	+559.71
				1	village forest	river	-4.3
				4	forest	river	-6.24
		Oriyasal	6	50	waste land (patita & Oth.)	sea	-48.56
				2	Forest	sea and mudflat	-76.08
		Paunsiapal	7	36	waste land (patita & Oth.)	sea	-35.93
				1	village forest	sea	-11.23
				1	river	mudflat and mangrove	+71.31
		Mundatalasaha dakani	8	6	forest	river	-110.55
				11	waste land (patita & oth.)	mudflat and mangrove	+14.69
		Baro	9	2	forest	river	-30.21
		Jogidhankud	10	3	forest	river	-118.66
				1	river	mangrove	+52.73
				1	river	scrub land	+73.58
	RAJNAGAR	Barunai	11	1	sandy area	mangrove	+48.96
				1	river	mangrove	+4.27
		Karanjia	12	6	sea	Casuarina plantation & mangrove	+116.33
		Kanhupur	13	21	crop land	sandy area	-15.20
				37	crop land	sea	-14.98
				3	Govt.planning land	sea	-3.68
				4	waste land (gochar)	sea	-8.48
				2	village forest	sea	-2.96
				17	homestead	sea	-1.21
				70	waste land (patita & oth.)	sea	-41.92
				23	sandy area	sea	-14.58
		Talapata	14	3	village forest	sea	-23.00
				1	sandy area	sea	-0.56

				2	waste land (patita & oth.)	sea	-1.35
		Guhipur	15	6	forest	sea	-86.44
				16	waste land (patita & oth.)	sea	-6.6
				2	river	sea	-6.77
		Junupanga	16	2	forest	sea	-114.19
		Jaudia	17	14	forest	sea	-9.67
				1	homested	sea	-0.08
				84	waste land (patita & oth.)	sea	-38.72
				16	public land	sea	-2.18
				2	crop land	sea	-5.4
				3	govt. planning land	sea	-0.69
		Teisimouza	18	10	Wasteland (gochar)	sea	-6.43
				167	forest	sea	-119.17
				31	waste land (patita & oth.)	sea	-18.54
				18	govt planning land	sea	-5.51
		Paramanandapur	19	4	sandy area	sea	-69.81
		Mohanpur	20	4	sea	sandy area	+66.95
		Kaduanasi	21	1	forest	sea	-12.003
		Badagahirmat ha	22	7	waste land (patita & oth.)	sea	-1.96
				33	sandy area	sea	-41.48
		Sanagahirmath a	23	24	sandy area	sea	-23.26
		Baghadia	24	28	waste land (patita & Oth.)	sea	-9.79
JAGATSIN GPUR	ERSAMA	Harisipurgar	1	14	forest	sea	-210.57
		Saharabedi	2	2	reservoir	sea	-86.65
				2	forest	sea	-51.35
		Padampur	3	1	waste land (gochara)	sea	-107.5

				1	forest	sea	-58.05
				3	waste land (patita & oth.)	sea	-84.59
		Jatadhar-171	4	9	waste land (patita & oth.)	river	-218.84
		Sandhakuda-487	5	11	forest	sea	--1162.24
				5	homestead	sea	-19.61
				7	river	sea	-633.55
				2	river	mudflat and mangrove	+96.8

the land records are not updated and substantial changes have been noticed are presented in Figures 1-3. It has been seen that some land masses have been utilized for afforestation and no mention in the land record. Aquaculture ponds have been constructed on accretional lands and there is least control in the area on land ownership there by losing revenue by the local government

CONCLUSION

The results show that the information generated are helpful in demarcation of newly emerged landforms, scope for additional revenue generation, land development for forest regeneration, tourism, industrial activity, identification of coastal eco-sensitive zones, pisciculture, security of the coast and monitoring illegal infiltration etc. This information also may help the resource planners of the ongoing Integrated Coastal Zone Management Plans (ICZMP) adopted by the state government under World bank assisted programmes

Table 2. Land accretion details not recorded in Cadastre

Dist.Name	Block_Name	Occurrence in Patches	Area in Acre
Jagatsinghpur	Balikuda	Sandy Area	157.972
		Sandy Area	415.621
	Ersama	Sandy Area	256.46
		Sandy Area	96.326
	Kujanga	Sandy Area	69.811
Kendraparha	Mahakalpada	casurina plantation	147.103
		sandy area	329.83
		Casurinna Plantation	1170.469
		Sandy Area	38.671
		Mangrove	667.082
		Mangrove	359.7
		Casurinna Plantation	236.468
		sandy area	82.456
		sandy area	145.348
		Sandy Area	480.113
		Casurina Plantation	12.603
	Rajnagar	Mangrove	3885.765
		Sandy Area	110.373
		Sandy Area	205.658
		Casurinna Plantation	352.29
		Sandy Area	17.623
		Sandy Area	38.846
		Sandy Area	21.159
		Sandy Area	193.683
Sandy Area	58.433		

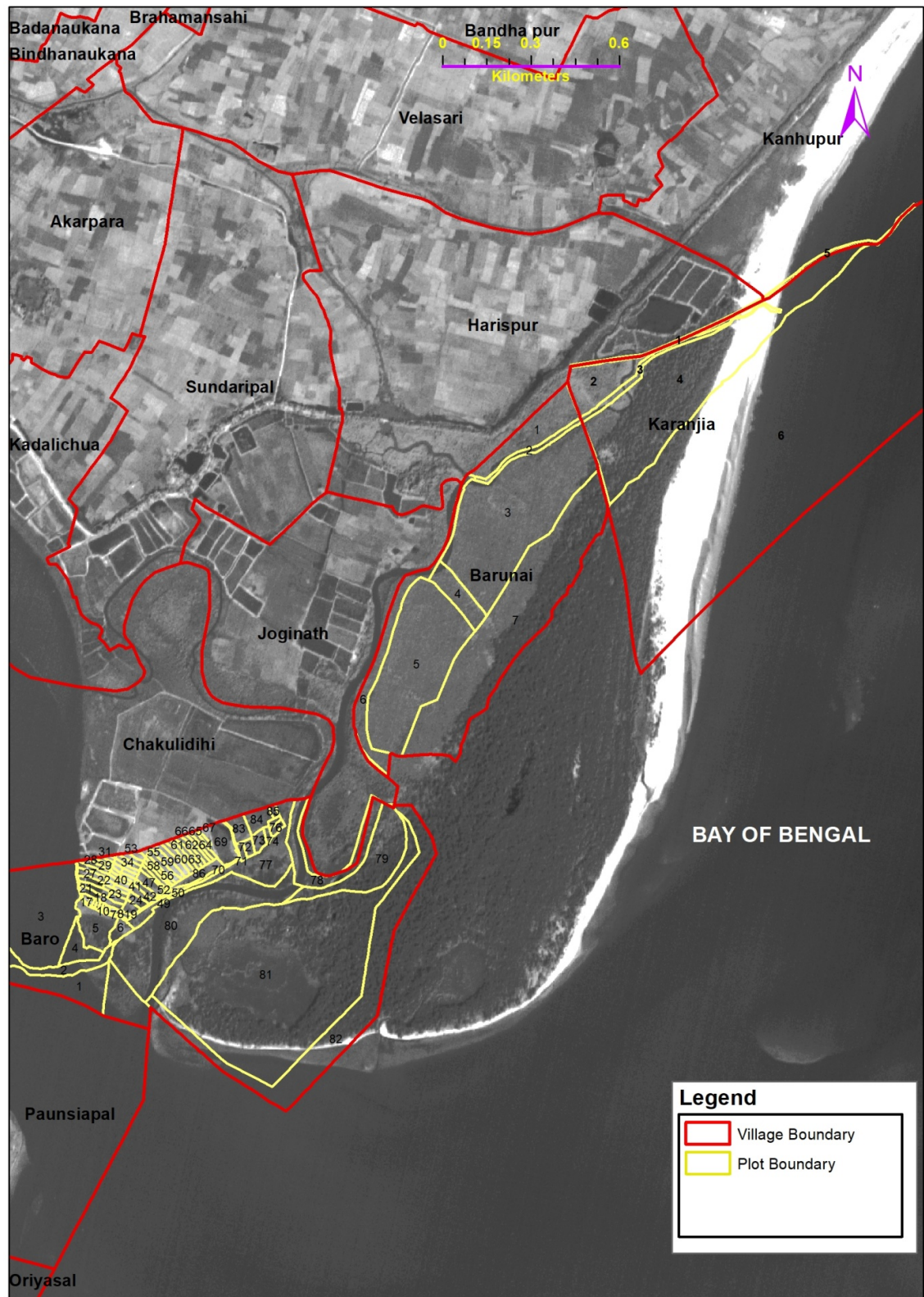


Figure 1. Land accretion and forest near Hansua River mouth, Not recorded in Cadastral maps.

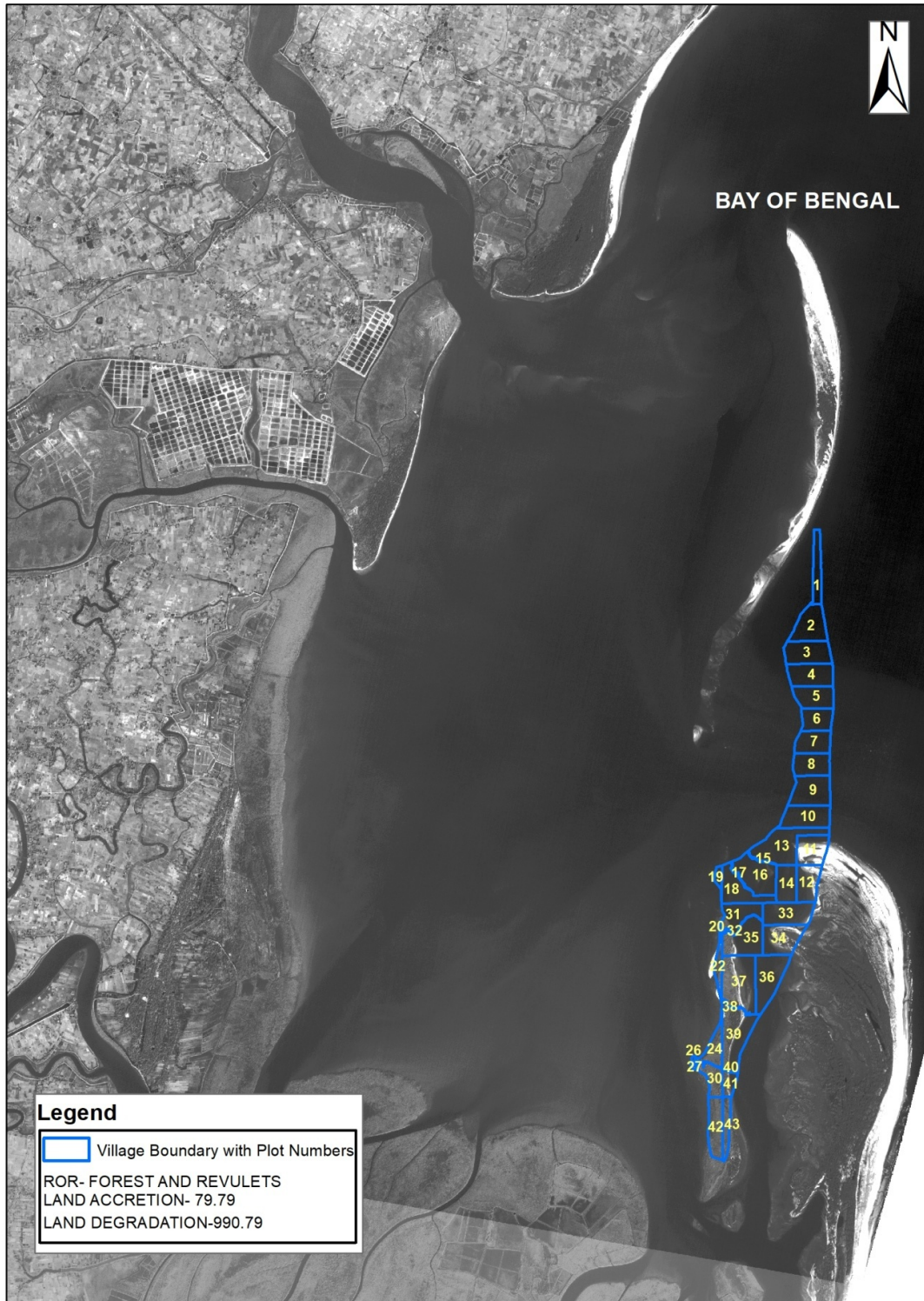


Figure 2. Village near Hukitola Bay now inside sea and changed to different land use



Figure 3 Cadastral plots of villages now inside sea needing updation

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