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IRS data processing for the assessment of Change Detection in Agriculture

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Abstract— This paper has proposed a approach for the assessment of agricultural change detection using IRS data processing. The proposed approach shows a relative change percent in agriculture .Agriculture is the sole source of our economy. India is an agricultural country more than seventy percent peoples are engage in the agricultural activities. In the present study after the interpretation of IRS data of several years, it is clearly shown that the method to assess the relative agricultural change percent is more liable for agriculture purpose. The proposed approach will provide a new way for agriculture study in the field of GIS.

Keywords— *Change Detection, IRS Data, GIS, SOI, Relative Change Percent*

I. INTRODUCTION

India is predominantly depending upon agriculture. Agriculture has been and will continue to be the lifeline of Indian economy. As the largest private enterprise in India agriculture contributes nearly one forth to the national GDP, sustains livelihood of about two third of population and is the backbone of the agro based industry[5]. Land and water form the basic and essential resources for mankind these should be utilized to the optimum in the most careful manner (CCREM, 1987). Remote sensing and GIS techniques are being used in the study of resource management. GIS and Remote Sensing play an important role in generating automated spatial datasets and in establishing spatial relationships. Obtaining information about an object/phenomena or area through the analysis of data acquired by a device that is not in contact with the object under investigation is termed as Remote Sensing[2]. This technology includes both Satellite and aerial remote sensing. The basic source is electromagnetic radiation and this energy comes from the sun reaches the earth surface and again reflected or transmitted or absorbed by the objects, which is collected by the satellite sensors or recorded. The reflectance/remittance/absorption of energy by an object forms the base for the brightness or darkness in an image.

II. THE AREA OF STUDY

The study area exhibits between 25^0 $30^{'}$ $00^{''}$ N to 25^0 $45^{'}$ $00^{''}$ N latitudes and 77^0 $45^{'}$ $00^{''}$ E to 78^0 $00^{'}$ $00^{''}$ E longitudes on SOI Toposheet number 54G/14. Central Upper Sind Catchment spread over Karera, Shivpuri and Narwar Tehsils of Shivpuri District.

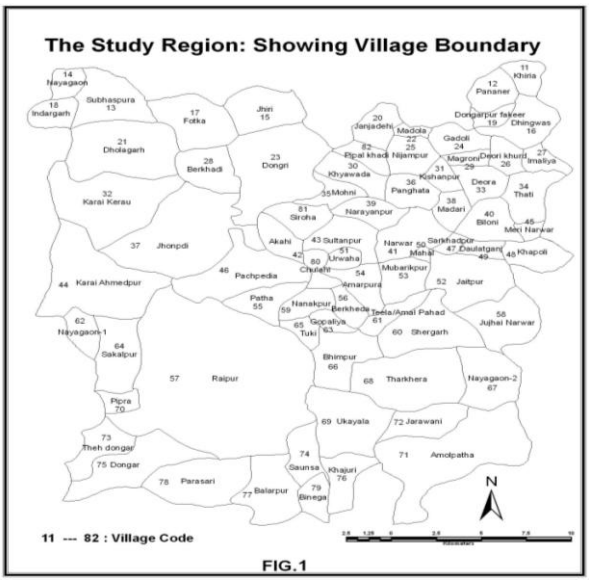

Figure.1 Study Area

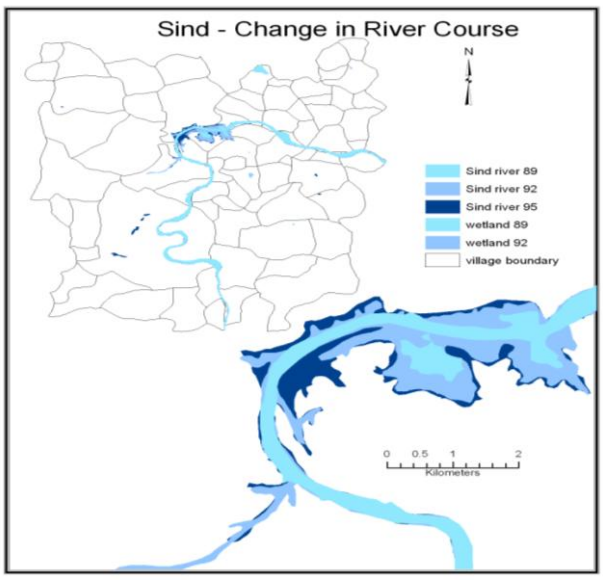

Figure.2 Changing Pattern in River Sind Course

It covers an area of 72879.83 ha and administratively it occupies 72 villages of around the newly constructed Mohini Dam on Sind River near Narayanpur and Siroha villages in Narwar Tehsil Figure 1 and Figure 2. The western part of river Sind exhibit hilly tracts, high uplands and covered with dense forests. Agriculture activities were limited to valley and intervening basins. The result shows after the construction of dam on Sind River irrigation facility has been increased. Farmers are growing crops during *Rabi* season even along the river that was earlier covered with natural grasses and scrubs. The area under agriculture in 1989, 1992, 1995, 2000 and 2005 were 16.00, 19.14, 25.78, 27.07, and 27.04 percent respectively, gradually which is having an increasing pattern.

III. METHODOLOGY

The sources of primary data are satellite imagery of different years, SOI toposheet and intensive field survey, Ground truthing and personal interview. ArcGIS and Erdas Imagine were used for the generation of base map and other thematic maps. Visual image and digital image interpretation technique were applied for the interpretation, analysis, classification and mapping of IRS imageries. Satellite data viz.; IRS 1A (1989), IRS 1B (1992 and 1995), IRS 1D (2000) and P6 (2005) were used and analyzed for the study of relative change detection in agricultural pattern. The base map of the study area was generated with the SOI toposheet on 1:50000 scale. Visual interpretation and generation of theme based layers of FCC has followed with tone, texture, pattern, shape, size, and association. After the interpretation following steps were adopted for delineation of agricultural relative change percent these are topology building, Georeferencing, Transformation, Root Mean Squire (RMS) Error check, Define Projection System, Creation of Geo-relational data base.

IV. RESULT ANALYSIS

The base year 1989 were selected for the generation of relative change percent data. The relative Change Percent (RCP) was calculated as 31.37, 97.81, 110.67 and 110.41 percent for the period 1989-1992, 1989-1995, 1989-2000 and 1989-2005 respectively is shown in Table 2. The study reveals that maximum change (110.67%) was noticed in the period 1989-2000. The village level changes (positive or negative) were presented by thematic map as shown in figure 3 and the trend of RCP during the said period was presented in figure 4. Based on the village level data of Relative Change Percent (RCP) of cropped area, the region was grouped under positive (high, medium & low) and negative (high, medium & low) changes and the same information has been presented for the period 1989-1992, 1989-1995, 1989-2000 and 1989-2005.The variation in RCP can be noticed at village level in each selected period of time. The Highest Positive Change (HPC) was recorded in Chulhi (749.04), Akahi (588.46), Khapoli (472.61) and Daulatgunj (247.35) villages during the periods of 1989-1992, 1989-1995, 1989-2000 and 1989-2005 respectively as shown in Figure 3 and Table 2.It is evident from the Table 1 that the percentage of villages grouped under HPC were 18.06, 51.39, 45.83 and 47.22 percent during the periods 1989-1992, 1989-1995, 1989-2000 and 1989-2005 respectively where as the percentage of villages with Highest Negative Change (HNC) were 1.39, 1.39, 8.33 and 11.11 percent respectively for the said period. The results indicated the dependency of crop production on irrigation in recent past. It is very much clear from the table 2 that the percentage of village with Positive Change (PC) in cropped area were 73.62, 88.89, 84.72 and 80.55 percent respectively during the said periods. The erratic and low rainfall in the years 2000 and 2005 was the main cause of reduction in area under crops. The Positive Change (PC) was recorded in 53, 64, 61 and 58 villages for the same period and the Negative Change (NC) in 19, 8, 11 and 14 villages for the respective years.

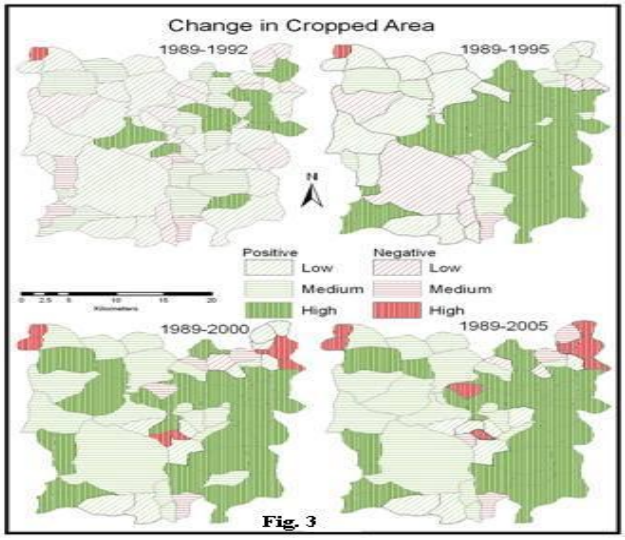

Figure 3. Relative change percent class of cropped area

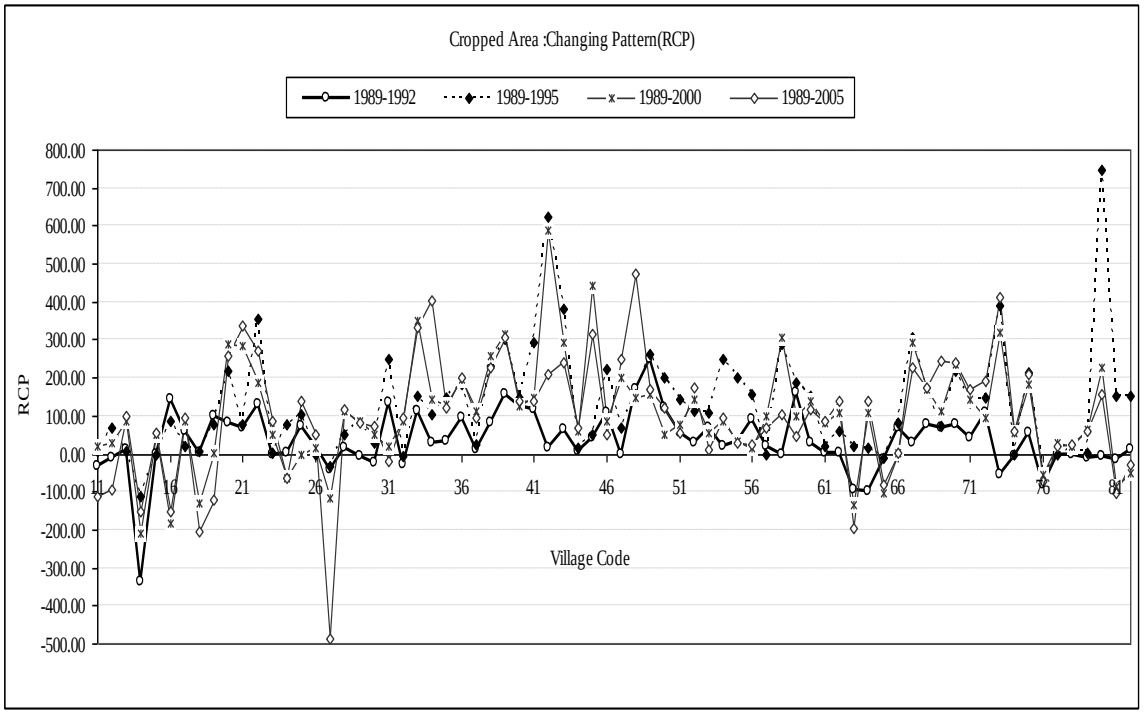

Figure 4- Cropped Area Relative Changing Percent (RCP)

TABLE: 1 - RELATIVE CHANGE PERCENT CLASS OF CROPPED AREA

		1989-1992		1989-1995		1989-2000		1989-2005	
Sl. No.	**Class(RCP)**	***NOV***	***%***	***NOV***	***%***	***NOV***	***%***	***NOV***	***%***
1	Positive Low(0 to 50)	22	30.56	15	20.83	10	13.89	8	11.11
2	Positive Medium(50 to 100)	18	25.00	12	16.67	18	25.00	16	22.22
3	Positive High>100	13	18.06	37	51.39	33	45.83	34	47.22
4	Negative low(0 to -50)	14	19.44	6	8.33	1	1.39	2	2.78
5	Negative medium(50 to 100)	4	5.56	1	1.39	4	5.56	4	5.56
6	Negative high(>100)	1	1.39	1	1.39	6	8.33	8	11.11

NOV = Number of villages

V. CONCLUSION

The main influencing factor of the positive change in the cropped area was increased irrigation facility after the construction of a dam on Sind River and creation of canal irrigation facility. Similarly the major cause of negative change in cropped area was related to rainfall variability and availability of irrigation water as well as utilization of cultivated lands in other developmental/ construction works. The additional land brought under cultivation during the said years (1989-2005) was mainly from forest, fallow lands and shrubs infested land. The lower slope of isolated hillocks situated in eastern part of the study area was brought under cultivation after the extension of irrigation canals from Mohini reservoir.

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TABLE: 2- RELATIVE CHANGE PERCENT (RCP) IN CROPPED AREA

Village Code	Village Name	Relative Change Percent (RCP)				Village Code	Village Name	Relative Change Percent (RCP)			
		1989 -1992	*1989 -1995*	*1989 -2000*	*1989-2005*			*1989-1992*	*1989-1995*	*1989-2000*	*1989-2005*
11	Khiriya Sunwai	-31.75	5.48	18.85	-110.20	47	Sarkhadpur	-0.95	70.53	199.28	249.80
12	Pananer	-12.68	67.18	29.92	-93.71	49	Daulatganj	247.35	261.15	157.42	171.97
13	Subhaspura	10.87	8.56	84.62	98.15	50	Mahal	119.73	199.05	52.83	119.25
14	Nayagaon (Dhol.)	-336.79	-113.36	-208.61	-152.43	51	Urwaha	56.73	143.60	78.09	53.65
15	Jhiri	0.00	0.00	50.49	55.65	52	Jaitpur	28.30	112.91	142.89	174.34
16	Dhigwas	142.05	87.46	-182.78	-150.34	53	Mubarikpur	69.09	109.87	56.15	9.66
17	Fotka	61.23	18.57	83.94	94.24	54	Amarpura	18.24	249.52	85.30	96.39
18	Indargarh	3.84	6.72	-131.56	-202.82	55	Patha	35.01	201.26	35.11	30.17
19	Dongarpur Fakeer	98.29	77.79	2.47	-119.37	56	Berkheda	89.57	156.46	16.81	24.70
20	Janjadehi	82.38	216.53	287.83	260.13	57	Raipur	20.27	-0.79	99.43	66.63
21	Dholagarh	69.26	78.76	283.79	338.82	58	Jujhai Narwar	-1.01	290.44	308.47	102.59
22	Madola	128.95	356.83	188.14	271.62	59	Nanakpur	159.67	189.64	100.93	44.44
23	Dongri	0.00	4.06	51.29	86.76	60	Shergarh	28.37	153.35	141.13	114.91
24	Gadoli	2.39	75.28	-62.48	-64.98	61	Teela	1.84	17.90	79.84	88.01
25	Nijampur	71.48	103.48	-4.20	137.72	62	Nayagaon-1	2.76	60.87	109.37	137.44
26	DeoriKhurd	20.65	-1.03	15.49	49.48	63	Gopaliya	-93.78	22.19	-132.81	-193.98
27	Imaliya	-40.62	-34.49	-114.58	-485.07	64	Sakalpur	-99.92	15.57	108.28	140.99
28	Berkhadi	14.50	50.83	113.12	115.24	65	Tuki	-16.46	-11.68	-102.93	-82.05
29	Magroni	-8.04	83.34	87.96	83.29	66	Bhimpur	70.01	81.67	4.45	0.77
30	Khyawada	-24.51	26.66	51.35	72.02	67	Nayagaon-2	29.76	308.48	293.93	226.60
31	Kishanpur	135.57	246.98	20.43	-19.23	68	Tharkhera	75.09	163.86	167.77	175.78
32	Karai Kerau	-28.37	-5.41	85.28	94.20	69	Ukayala	69.33	71.23	112.41	243.00
33	Deora	113.75	150.25	352.61	334.50	70	Pipra	78.12	218.35	235.44	241.80
34	Thati	28.55	104.78	142.28	403.12	71	Amol Patha	42.32	136.16	145.23	168.88
35	Mohni	33.48	149.71	130.94	121.73	72	Jarawani	110.30	146.55	94.97	192.00
36	Panghata	94.91	183.19	196.47	201.68	73	Theh Dongar	-55.26	388.62	319.54	413.56
37	Jhonpdi	9.45	25.91	113.21	95.81	74	Saunsa	-6.59	-1.51	53.76	59.93
38	Madari	81.43	230.96	257.01	227.62	75	Dongar	53.90	212.28	184.88	208.56
39	Narayanpur	154.43	302.67	313.06	306.48	76	Khajuri	-81.24	-60.10	-56.16	-72.07
40	Biloni	125.65	147.92	126.50	140.89	77	Balarpur	0.00	0.00	30.10	22.15
41	Narwar	115.42	291.08	149.97	136.92	78	Parasari	0.00	14.13	20.36	22.44
42	Akahi	14.40	624.43	588.46	207.94	79	Binega	-10.21	1.27	63.63	61.84
43	Sultanpur	63.37	380.84	291.78	238.70	80	Chulhi	-7.61	749.04	227.39	154.69
44	Karai Ahmedpur	6.13	17.53	61.19	70.18	81	Siroha	-15.56	150.40	-84.57	-103.19
45	MeriNarwar	41.98	52.26	441.02	316.37	82	Pipal Khadi	13.17	152.99	-51.60	-30.56
46	Pachpedia	108.15	223.76	85.14	51.04		**Total**	**31.37**	**97.81**	**110.67**	**110.41**

