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Impact Assessment of Narwa Programme Through Remote Sensing (RS) and Geographical Information System (GIS)

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***Abstract*—** Impact assessment of Watershed based project require long-term implementation, impact analysis, a good qualitative measurement for project development. Considering the ability of remote sensing technology in Narwa project monitoring and impact assessment. A study was carried out to investigate the Impact assessment of Kasdol block in Baloda Bazar district, Chhattisgarh. (Under Narwa Project, MGNREGA). This analysis was carried out using satellite data of two different year i.e. **PROBA-V satellite observations -Sentinel-2 –** 2015 (pre-treatment) & 2019 (post-treatment). The Land use and Land cover map was prepared by using supervised classification techniques.

The result shows that there has been no major shift in cropping pattern over a period of 5 years (2015-2020). Decrease in scrubland (47.84 ha decrease) its mean cropped area showed that there was increase in irrigated land. Permanent waterbodies increase (31.89 ha) its good indication for the sustainability of water (more than 800 water harvesting and conservation structure prepared). Wetlands also increase (583.78 ha) its mean soil and water conservation activity a huge changes in terms of water crisis. Some of the forest area decrease due to FRA land distribution, its convert farmland/build up land.

The Normalized difference Vegetation Index (NDVI) of Kasdol block has been prepared 2018 to 2020, monthly composite data. These NDVI maps indicate that there was a significant change in biomass status of Kasdol block area due to MGNREGA interventions.The benefit-cost analysis indicates that the use of remote sensing technology was 2 times cheaper than the conventional methods. Thus, the repetitive coverage of the satellite data provides an excellent opportunity to monitor the land resources and evaluate the land cover changes through comparison of images for Narwa watershed at different periods.

***Keywords*— LULC, MGNREGA, Narwa, NDVI, Satellite**

I. INTRODUCTION

Watershed management is perceived by many as a viable approach for increasing agricultural production in rainfed marginal areas on sustainable basis. Many countries in the world including India are investing billions of rupees in treating several millions hectares of land on watershed approach. Unfortunately monitoring and evaluation has not got its share of attention and therefore it is very difficult to quantify and assess the changes which have taken place not only in natural resources but also in livelihoods of people due to these programmes and in the long run to justify the need for these schemes (Kallur 1991; Randhir and Ravichandran 1991; Anonymous 1998). There is often not enough room for midterm adjustments in ongoing programmes due to lack of a proper monitoring system. The need therefore arises to identify a quick and cost effective technique for monitoring the impact of such schemes on a 'before project—after project' temporal scale as well as during project implementation stage (Agnihothri et al. 1986; Singh et al. 1989; Sabins 2000).

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Satellite data have been used for monitoring and evaluation of watersheds to assess the impact of development over the years. In order to improve the productivity of rainfed agriculture, the Govt. of Chhattisgarh over the last two decades has initiated number of integrated watershed development programmes in the state. Taking the present day importance of impact assessment in watershed development programme and capabilities of remote sensing, GIS and GPS technologies in watershed management, a study was carried out on impact assessment of Kasdol block in Balodabazar district, Chhattisgarh, with an objective to study the impact assessment of Narwa project.

II. MATERIALS AND METHODS

Study area:

Kasdol is a Tehsil / Block (CD) in the Balodabazar District of Chhattisgarh. According to Census 2011 information, the sub-district code of Kasdol block is 03328. Total area of Kasdol is 1,665 km² including 1,636.21 km² rural area and 28.94 km² urban area. Kasdol has a population of 2,17,688 peoples. There are 47,636 houses in the sub-district.

The average Rainfall (June to Oct.) 974.4 mm (Avg. of 2012 – 2020).

Data used:

The Copernicus satellite data was use for the impact assessment, the output prepared Land use and land cover classification. For NVDI the NEO NASA satellite data (1 month Terra/MODIS) use for the proper identification of vegetation heartiness'.

ArcGIS, Erdas Imagine and QGIS use for this analysis.

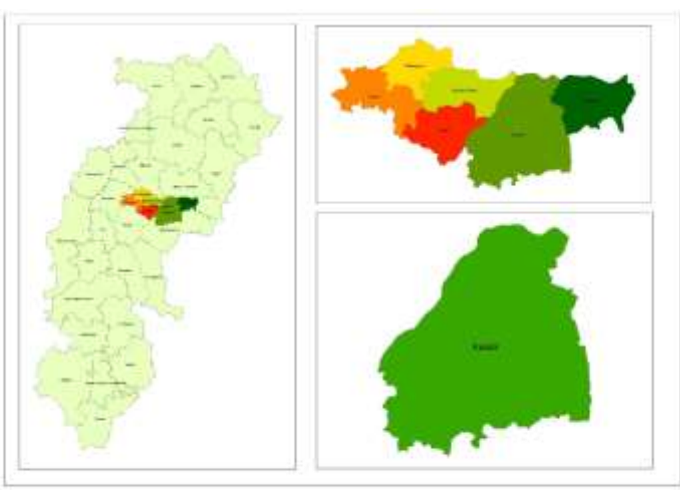

Figure 1 Location map of selected block Kasdol, Balodabazar district, Chhattisgarh

III. PREPARATION OF LAND USE/LAND COVER MAPS

The classification of images was done using Gaussian Maximum Likelihood Algorithm (MXL) as suggested by Lillesand and Kiefer (2000). The LULC indicating the methodology for watershed impact assessment using remote sensing and GIS techniques is shown in the fig-2

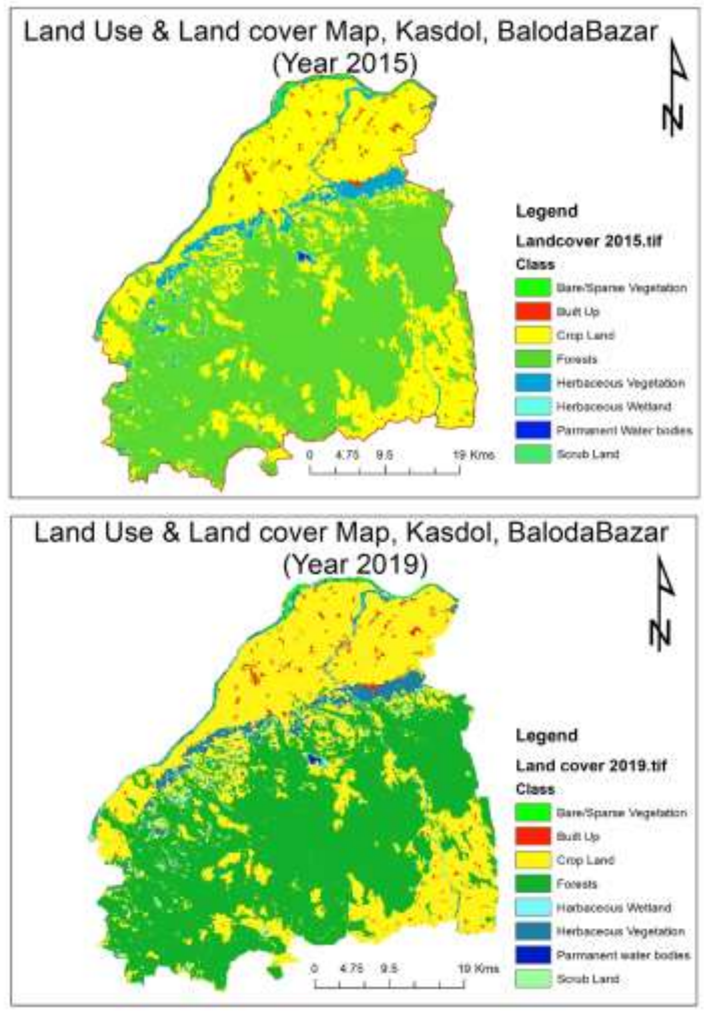

Figure 2 Land use and Land cover Map (two time series 2015 and 2019)

The exact analysis showing increase in Waterbodies formation and increase rate on Built-up areas. Inland Waterbodies increase (31.89 ha) its good indication for the sustainability of good water management. Wetlands also increase (583.78 ha) its mean soil and water conservation activity a huge changes in terms of water crisis. Some of the forest area decrease due to FRA land distribution, its convert farmland/build up land.

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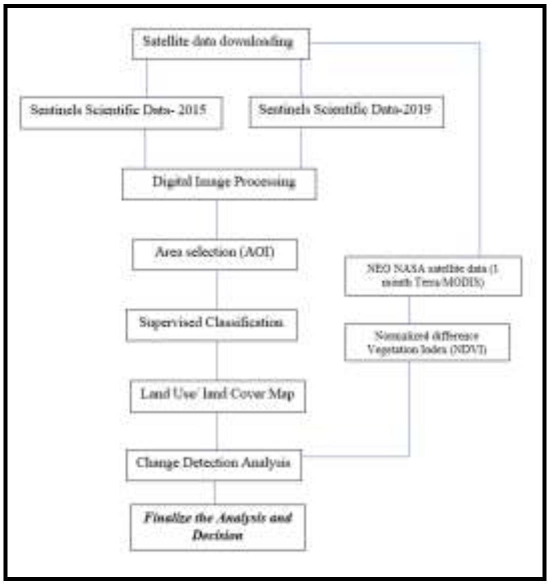


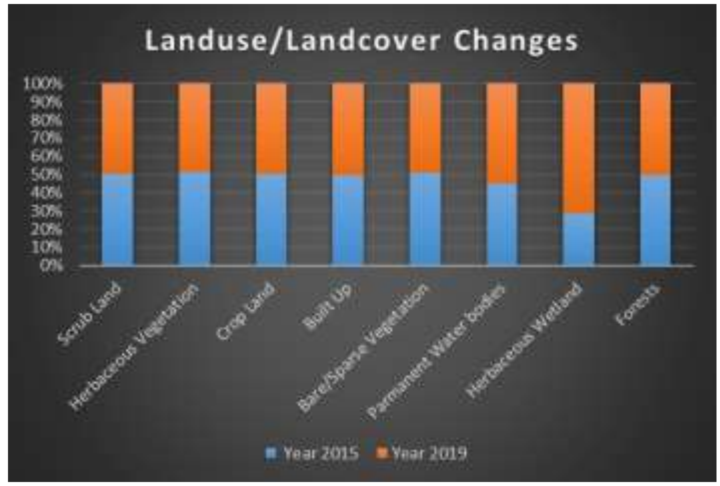
Figure 3 Methodology flow chart of watershed impact assessment using remote sensing and GIS techniques

LULC Year 2015		
Grid code	**Classification**	**Area in Ha.**
1	Scrub Land	3047.29925
2	Herbaceous Vegetation	7826.420034
3	Crop Land	65055.36033
4	Built Up	1687.171625
5	Bare/Sparse Vegetation	914.2972082
6	Permanent Water bodies	134.9207559
7	Herbaceous Wetland	385.7310329
8	Forests	88096.28774

Table 1 Land use land cover 2015

LULC Year 2019		
Grid code	**Classification**	**Area in Ha.**
1	Scrub Land	2999.456641
2	Herbaceous Vegetation	7386.21399
3	Crop Land	64964.43407
4	Built Up	1689.618844
5	Bare/Sparse Vegetation	877.5966076
6	Permanent water bodies	166.8121717
7	Herbaceous Wetland	969.5184634
8	Forests	88091.88724

Table 2 Land use land cover 2019



Generation of Normalized Difference Vegetation Index (NDVI) Maps

The NDVI is highly correlated with vegetative parameters such as green leaf biomass, leaf area and is an indicator of photosynthetic activity; hence it is of considerable value for vegetation discrimination and seasonal monitoring. NDVI has been used to describe vegetation dynamics and monitor the seasonal growing conditions for making primary productivity analysis. NDVI is computed by using the infrared (IR) and red reflectance data as given below:

$$\mathrm{NDVI} = \frac{(\mathrm{NIR} - \mathrm{Red})}{(\mathrm{NIR} + \mathrm{Red})}$$

The values for NDVI range from −1.0 to +1.0. Vegetated areas generally yield high values of NDVI because of their relatively high NIR reflectance and low visible reflectance. Water, snow and clouds have negative IR radiation. Rocks and bare soil have NDVI values around zero and even negative values since they have similar reflectance in both the bands and represent areas without any vegetation cover. Only green vegetation has positive NDVI values and high values being associated with higher densities /vigour of any given healthy biomass (Sabins 2000; Lillesand and Kiefer 2000). NDVI maps were generated by using the above equation for the study area for both the periods. The study area was classified into the following different biomass levels like High, Medium and Low, the area under each class was calculated.

In 2020 last increase the value its mean biomass increase for long time.

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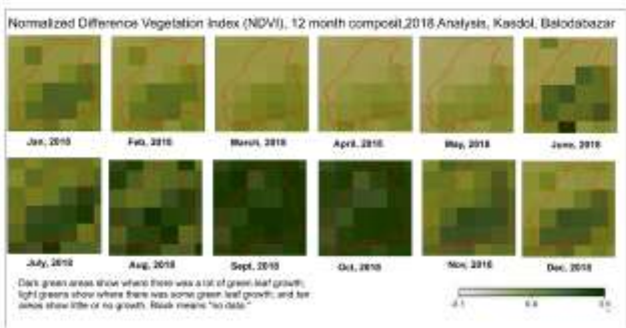

Figure 4 NDVI analysis 2018

In February to May NDVI values shown the medium biomass index, but after that up to December end. It will shows the healthy vegetation signature.

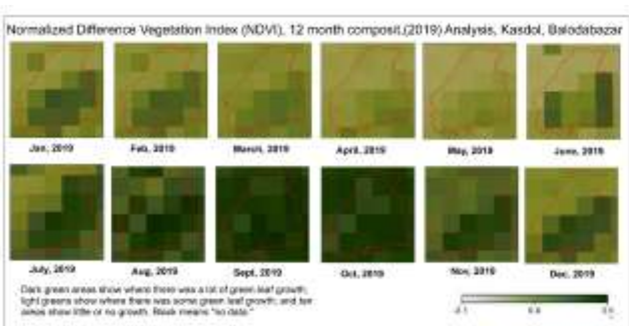

Figure 5 NDVI Analysis 2019

Here this analysis shows the NDVI values getting higher side, indicates higher biomass & moisture development.

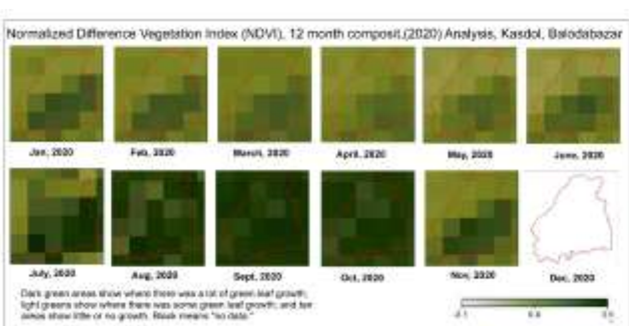

Figure 6 NDVI Analysis 2020

The level of vegetation every month getting healthy. It has clearly identified soil moisture getting increase that is why vegetation biomass increasing step by step.

Conclusion:

The result was clearly visible, rapid water harvesting and water conservation activity constructed in Kasdol block, Baloda Bazar district, Chhattisgarh under MGNREGA project. This was clearly visible impact due to 100 days MGNREGA works. The Impact analysis process was extreme cheap, accurate & scientifically authentic with field data. Therefore, it is recommended the remotely sensed data professionally offer a diamond source of information for planning process, management and developments on the earth's surface that change over time.

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This Paper dedicated to Trishika