

## Land Use Changes due to Coal Mining Activities: A Case Study of Singrauli Coalfield, Central India

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Singrauli coalfield lies in central India and is managed by Northern Coalfields Ltd. (NCL), a subsidiary of Coal India Ltd. The coalfield covers an area of over 300 sq km and is one of the most important coalfields in India both in terms of reserves and productions. The coalfield produces high-quality coal used primarily for thermal power generation by many Super Thermal Power Stations (STPS) in the adjoining areas. Singrauli coalfield has coal reserves to the tune of 1789.41 million tones. There has been a steep rise in the coal production from 35.2 million tonnes in 1995-96 to 49.95 million tonnes in 2004-05.

The geology of the area is represented by Pre-Cambrian gneiss, schists, quartzite and phyllites, which are overlain by Gondwana rocks defined by Talchir, Barakar, Barren Measures and Raniganj formations (Singh et al, 1997). The drainage in the area is defined by main Rihand river and its tributaries Kanchan and Mayar, besides many other smaller streams are also present. Drainage pattern is dendritic to sub-dendritic but at places structural control drainage has locally developed. Majumdar and Sarkar (1994) carried out a study on the impact of mining and related activities on the environment around Singrauli coalfield. They compared land use data of pre-mining and industrialization period with post mining and industrialization period in order to assess the impact on cultural and physical environment of Singrauli coalfield. Singh et al. (1997) also carried out land use change analysis in and around Singrauli coalfield using multi-temporal satellite data. They concluded that there have been larger scale changes in land uses between 1975 and 1991. These changes were mainly reduction in forest cover, and increase in the area under degraded forest. However, efforts by NCL under its 'Green Gold' programme have yielded good results in protecting the environment and reclamation of degraded lands during 1986-1991 period.

The present study makes an attempt to analyse the land use and land cover changes which have taken place in the recent past (1993-2003). The study uses multi-spectral and multi-temporal data of Indian Remote Sensing Satellites pertaining to 1993 and 2003. Survey of India toposheet 63 L/12 on 1:50,000 scale was used for preparation of base map and familiarizing with the general topography of the study area. Besides, secondary data obtained from other published and unpublished sources such as Journal of Indian Society of Remote Sensing (JISRS), internet ([www.ncl.nic.in](http://www.ncl.nic.in), [www.ntpc.com](http://www.ntpc.com), [www.sighi.nic.in](http://www.sighi.nic.in)), etc. were also helpful. Base map of the area having details such as settlements, road and railway line network, rivers and water bodies, etc. was prepared from Survey of India toposheets. Base map was superimposed on geocoded False Colour Composite (FCC) data for visual interpretation which led to the identification of various land cover categories in the study area. Land cover categories such as agricultural land, wasteland, open scrub, open forest, dense forest, degraded forest, mine pits, over burden, etc. were delineated on the satellite data on the basis of photographic recognition elements. Two time series data of 1993 and 2003 were used for monitoring the land cover changes which have taken place due to the coal mining activities. Limited ground truth verification was conducted before finalization of the land cover maps. The maps were then digitized using ArcInfo GIS software and polygon topology was built assigning unique id for each polygon showing the land use category demarcated on the map. The area under each category of land cover was determined and a matrix was prepared to assess the changes which have taken place during the 1993-2003

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period, due to mining activities. It is interesting to note that the area under dense forest has been adversely affected and has reduced from 77 sq km in 1993 to only 2.0 sq km in 2003, primarily due to the new coal mining blocks where mining has expended into the deep inside the forest. However, open forest has almost remained the same during this period, but there is substantial increase in the open scrub from 6 sq km in 1993 to 61 sq km in 2003, mainly due to the plantation activities undertaken by NCL. The positive side of the coal mining activities and its related development in terms of industrial development (e.g. availability of water in the reservoir) has resulted in expansion of agriculture, which has shown an increase in area from 68 sq km in 1993 to 100 sq km in 2003. This increase is due to the declamation of the wasteland and bringing the land under agriculture due to the initiative of the NCL with local community. The wasteland has reduced from 21 sq km in 1993 to 3.0 sq km in 2003. The land use changes in Singrauli area represent a mix of positive and negative environmental changes from 1993 to 2003 period as has been assessed by the satellite data (Table 1).

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Table 1: Change in Singrauli area under land cover from 1993 to 2003

Land use category	Area (sq km) 1993	Area (sq km) 2003	net change (sq. km)	% Change
Agriculture	68.13	100.83	32.70	47.99
Dense forest	77.70	2.26	-75.45	-97.09
Open scrub	5.91	61.92	56.01	947.67
Open forest	54.15	50.75	-3.40	-6.28
Thermal power plant	6.59	7.08	0.49	7.47
Barren land	7.26	9.34	2.08	28.69
Water body	40.98	45.98	5.00	12.20
Mine pit	12.13	6.97	-5.15	-42.49
Over burden	11.79	12.17	0.39	3.28
Wasteland	21.60	3.34	-18.26	-84.55
Ash pond	5.18	0.77	-4.41	-85.09
River sand	0.84	0.41	-0.43	-50.94
Fallow land	0.00	10.43	10.43	10.43
Total	312.25	312.25		

References:

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