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Rehabilitation prospects and opportunities for coal mine affected areas of eastern india

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Abstract

The coal mined areas require immediate attention for its rehabilitation, if the present situation is allowed to continue, it will degrade air quality, water quality and land productivity. Thus this will not only cause inconvenience to the people but also affect the health and environmental conditions. Hence, to create better condition and environment, one has to consider the various means and ways of rehabilitation, followed by area specific technological interventions. One of the interventions may be the plantations (*e.g.* afforestation/ reforestation/ agroforestry models). It is evident from earlier studies that, the performances of leguminous species like *Acacia catechu, Albizia lebbeck, Dalbergia sissoo* and *Pongamia pinnata* planted on mined areas are better than many others species. Even, bamboos like *Dendrocalamus strictus*, *Bambusa sp., etc.* are also found to grow well under such extreme mined situation. Hence, research efforts need to be strengthened further for identification of species with short gestation period suitable for coal mined areas and making available the quality planting material by establishing nursery.

Introduction

India has abundant domestic reserves of coal. Most of these are in the states of eastern India *viz.,* Jharkhand, Odisha, West Bengal, Bihar and Chhattisgarh. Coal mining is the major mining activity performed in the India. Presently, there are 581 coal mines in India (CSE, 2012) of which 177 coal mines are now in operation in Jharkhand (38 %). Jharkhand is the largest coal producing state in the country followed by Orissa (13.4 %), Chhattisgarh and West Bengal. In India coal contributes to about 55% of the commercial energy consumption as compared to 27% of world average where 60% of electricity generation capacities are coal based (IEA, 2015).

There are two types of methods applied for mining such as opencast mining and underground mining. Both produce huge amount of wastes, especially the opencast mining. Approximately 70% of the mining is expected to be done by open cast method (Sinha, 2013). It involves displacement of large amount of overburden to excavate the valuable mineral. In due course, the soils are affected by various activities such as blasting, drilling and quantity of explosives used and thus the soil, an important resource for land management is lost and it degrades the quality of agricultural land.

Consequences of coal mining activities

The most serious impact of mining is the land degradation. Besides, serious impacts of coal mining are impact on top

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fertile soil, microbial population, heavy metal toxicity, ecology and vegetation, habitat destruction and degradation of ecosystem as a whole. The mine spoils or overburdens created during opencast mining are devoid of nutrients and have low water holding capacity. These are chemically, physically and biologically unstable (Chaubey *et al.,* 2012). Coal mining activities are leading to loss of forest biodiversity and rich top soil (Sinha, 2013). The soil quality in those subsided areas had relatively low pH, low moisture content and high conductivity (Rai *et al.*, 2010). Das *et al.* (1992) in his preliminary report on coal overburdens in eastern India reported that pollution problems and soil erosion occurs due to mining activities, and hence destruction of soil properties too exist (Doubleday, 1974 and Sadhu *et al.,* 2010). Sharma and Agarwal (2005) studied on biological effects of heavy metals and found that plants physiological activities got affected due to presence of heavy metals.

Opencast mining is more severe to air pollution problem than underground mining. The high levels of suspended particulate matters increase the respiratory diseases like chronic bronchitis and asthma, while gaseous emissions contribute towards global warming besides causing health hazards to the exposed population. The sulphur dioxide, dust particulates, ozone, *etc*. caused by coal mining operation reduces the life expectancy (Garada, 2015).

Mining and its associated activities not only uses a lot of water but also affects the hydrological regime of the coal mine areas and often affects the water quality. Large and deep opencast mines usually have great impact on the hydrologic regime especially on the ground water regime of those areas (Tiwary, 2001). Therefore, there is utmost need to rehabilitate those coal mine affected areas to reduce it's adverse affect on surrounding environment.

Rehabilitation prospects and opportunities

It is seen that, many such coal mine affected areas got rehabilitated by the forest department, mainly focussing only on the rehabilitation and reclamation activities. But due to lack of scientific findings, forest officials are unable to rehabilitate those areas properly. Moreover, they are also not giving any emphasis on the needs of the local people.

Since past few decades, the coal mining and its affected areas rehabilitation programme was highlighting at every desks of concern. Even then no such scientifically and technically sound plantation systems or technology had been developed so far for livelihood security of native communities who live in and around those coal mine affected areas. But there are very little studies available, related to soil properties and particular plant growth parameters conducted by many workers. The available information is hardly being used for rehabilitation of such degraded land. Quite often, it is observed that, in most of the overburden dump areas, forest department generally do planting the hardy species like *Acacia* spp*., Cassia siamea, etc.* and broadcast the seeds of many other plant species including grasses primarily to stabilise the dump areas and to control soil erosion. They also have been engaged for plantation on roadsides besides plantation on the overburden dumps and other empty lands. Deo (2005) studied on vegetation and flora of an open cast mined area in South

Bolanda, Talcher, Odisha and reported that in mine waste, most of the plants grow well but some species show abnormal growth because of nutrient deficiency and presence of heavy metals. Singh (2015) reported that growth performance of selected leguminous species *viz., Acacia catechu, Albizia lebbeck, Dalbergia sissoo* and *Pongamia pinnata* was found better than non leguminous species except few like *Gmelina arborea* and *Azadirachta indica.* Many workers reported that bamboos like *Dendrocalamus strictus*, *Bambusa sp., etc.* can also be grown under such condition. In many of the coal mine affected areas, afforestation with bamboos was reported successful (WCL, 2013). Mishra *et al.* (2007) reported that aquatic plants like *Eichhornia crassipes*, *Lemna minor* and *Spirodela polyrhhiza* can be used or planted for the removal of heavy metals from the coal mining effluent.

Hence, based on earlier studies, one can select the indigenous species to be grown at properly spaced and start developing various agroforestry models (like agrosilvopastoral, silvopastoral and agri-horti-silvi-pastoral systems) or multi-tier system approach for rehabilitating coal mine affected areas. Above all, species belongs to leguminosae family should be given the first priority followed by species specific characters like fast growing, low gestation period, deep tab root system, hardiness and locally valuable. Sarkar *et al.* (2017a, b & c) and Das *et al.* (2019) reported that, *Dalbergia sissoo*, *Melia azedarach, Gmelina arborea, Pongamia pinnata* and bamboos (Sarkar *et al.,* 2019) *etc*. are some of the important fast growing MPTs of this region, which might have the potential for being selected and evaluated during rehabilitation of such mined out areas. Hence, such type of fast growing potential species must be screened and selected for development of technology or any successful models or systems.

Overburden dump area

Rehabilitation programme initiated by Forest Department

Conclusion

It is evident from earlier studies that, the performances of leguminous species when grown for rehabilitation of coal mine affected areas are better than many other species. Hence, various plantation activities are to be carried out following the improved technology like agroforestry models. Further, the research efforts need to be strengthened for screening and identification of species with short gestation period suitable for coal mined areas and making available the quality planting material by establishing nursery.

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