

Rehabilitation of Lignite Mine Spoils in the Indian Arid Zone-An Ecological Approach

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Abstract: Rehabilitation of barren lignite mined spoiled lands was carried out in the Barmer district of Indian arid zone following ecological approach. Being highly sodic in nature, the spoil surface was overlain with a layer of dune soil in varying thickness. The three treatments of thickness of topsoiling were 30, 45 and 60 cm. Landshaping of resultant surface with 5% slope was done to make micro catchment for water harvesting. Multipurpose species of trees, shrubs, creepers and grasses were selected. Woody perennial saplings were prepared for transplantation in 60×60×60 cm pits filled with a mixture of local soil and FYM in 2:1 ratio. Plantation was carried out in three seasons i.e., July, September and March. Results revealed that overall survival of species planted at lignite mine spoil was 85.28%. Maximum growth was observed in *Parkinsonia aculeata* followed by other species. Month of March has proved to be better plantation season than July and September in high sodium containing backfill. Micro catchments did not favour the growth of planted species. Thickness of 60 cm topsoiling emerged as most optimum for survival and growth of species. Monitoring of species growth and survival revealed that most suitable species for lignite mine spoil back fill in this area are *Parkinsonia aculeata*, *Acacia nubica*, *Circidium floridum*, *Acacia tortilis*, *Salvadora oleoides*, *Dichrostachys nutans*, *Acacia senegal* and *Tecomella undulata* in that order. Role of local people and NGO's for participatory mine rehabilitation has been highlighted as a major future requirement of these programs.

Key words: Mining, lignite mine spoil, rehabilitation, lignite backfill, woody perennials.

Open cast mining of lignite entails removal of uneconomic earth up to lignite seams which is then piled in the form of overburden dumps. As the mining pit advances, huge volume of solid waste comprising low quality mineral, murrum and bentonite so excavated is refilled in the previously created abandoned mining pit to bring it to the level of adjoining land surface. This is called "Backfill". The overburden dumps due to stock piling of mineral waste occupy large areas of fertile land rendering them unfit for any economic activity. Mining muck heaps normally vary from place to place and type of mining in respect of height, slope, width, thickness, size of aggregates, voids besides their chemical constitution. In case of systematic dumping the height may range from 10 to 40 m. Final surface of backfilled pit is a result after many cycles of compaction of the mine waste by continuously rolling of heavy machinery. Uneven compaction results in highly compressed central area and loose periphery (Power *et al.*, 1978). This causes uneven subsidence, undulating surface, differences in surface drainage and finally

slope wash that adversely affects the adjoining land. This resultant surface is in fact a "spoil surface" and not the "soil surface" because it is completely devoid of fertile soil, flora and fauna. Both, overburden dumps and backfills have discontinuous rock-soil continuum (Harthill and Mckell, 1979) and thus represent drastically disturbed habitats that remain barren for years if left unattended. These barren landscapes of mining wastes are known to cause a large number of adverse ecological impacts which are both immediate and long term (Sharma *et al.*, 2004). These immediate impacts trigger long term effects of declining productivity in adjoining lands, disrupting hydrological processes and enhancing erosional hazards culminating in water and soil pollution and occupational hazards affecting ultimately the human health. Thus, these drastically disturbed ecosystems are extremely vulnerable to future anthropogenic changes at both, local and global level (Peters, 1985). Bringing such lands to a form and productivity in conformity with the land use plan for the site is therefore, an essential requirement legally as well as environmentally. This includes isolation of disturbance impacts to the site, limiting

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