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Restoration of Degraded Salt Affected Lands to Productive Forest Ecosystem

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Soil system determines the fluxes of energy and matter in the Earth and is the source of goods, services and resources to the humankind (Keesstra et al., 2012; Brevik et al., 2015; Keesstra et al., 2016). To restore and rehabilitate the soil system is a key strategy to recover the services the soils offers (Celentano et al., 2016; Galati et al., 2016; Parras-Alcantara et al., 2016). Transformation of degraded sodic lands in biodiversity rich productive forest ecosystem is a challenging task before the researchers all over the world. The soils of the degraded sites remain almost unfavorable for the normal growth, development and multiplication of organisms; all our attempts tend to alleviate the soil constraints. Land degradation due to presence of salts in the soil is an alarming threat to agricultural productivity and sustainability, particularly in arid and semiarid regions of the world (Tanji, 1990; Qadir et al., 2006). According to the FAO Land and Nutrition Management Service (2008), over 6% of the world's lands are affected by salinity, which accounts for more than 800 million ha in 100 countries. This is due to natural causes, extensive utilization of land (Egamberdieva et al., 2008), poor drainage systems and limited availability of irrigation water which causes salinization in many irrigated soils (Town et al., 2008).In India, about 6.73 million ha are salt affected which spread in 194 districts out of 584 districts in India and represents 2.1% of the geographical area of the country (Mandal et al., 2009).Out of these, 2.8 million ha are sodic in nature and primarily occurring in the Indo-Gangetic alluvial plains. These lands are degraded in structural, chemical, nutritional, hydrological and microbiological characteristics. The reclamation of salt affected soils with chemical amendments like gypsum and phospho-gypsum are in practice for the cultivation field crops under agricultural production. Forest development on such lands although takes considerable time but it appears to be driven by two parallel sets of ameliorative mechanisms like (i) fertility building process associated with organic matter addition, nitrogen accretion and nutrient recycling (ii) sodicity alleviation process driven by improved leaching that lead to reduced soil dispersion and less sodium toxicity. The index of these changes in the soil depends on the age of the forest. The present paper is based on the 15 years field study conducted to find out the rate and time that is required to achieve the status at par with a reference site of natural forest of the region, a stage where aim of degraded salt affected soils may be diverted to productive forest ecosystem. Changes in soil properties were recorded under canopy of various aged plantations. Most of the leguminous species raised on degraded sodic soils rendered an appreciable reduction in soil pH and exchangeable sodium (ESP), decrease in bulk density and increasing in soil porosity and water holding capacity. Exchangeable K, Ca, Mg and organic carbon content increased with plant growth and age. As a result of afforestation, a significant increase in soil organic matter (4 times) and decrease in pH from 10.2 to 8.6 were recorded. Total available N was increased 2-4 times in forested soil in comparison to barren soil.

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