



Influence of Human, Livestock Population and Land Use Systems on Soil Characteristics and Soil Organic Carbon Stock in Western Rajasthan

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Received: May 2018

Abstract: A study has been conducted during 2016-17 to estimate soil organic carbon stock in 0-30 cm soil depth as influenced by land use, spatial variations and human and livestock population for developing strategies to reduce land degradation and enhance carbon sequestration and land productivity. Forests, oran, pasture lands, agriculture, roadside and fallow land are different land uses covered in six Panchayat Samitis-called blocks viz. Abu Road, Baap, Baitu, Bali, Sanchor and Sankara situated in Sirohi, Jodhpur, Barmer, Pali, Jalore and Jaisalmer district, respectively in western Rajasthan. Land holding (2444-37444 m²), family size and livestock population in terms of head counts per household (HH⁻¹; 5.3-5.9 and 4.4-11.0, respectively) varied ($P < 0.05$) widely between blocks. Variations in soil gravel content, bulk density (BD), organic carbon (SOC) and carbon stock without (CSW) and with (CSG) gravel correction like 1.49-32.51%, 1.45-1.56 g cm⁻³, 0.114-0.584%, 5.31-25.37 t ha⁻¹ and 5.04-16.63 t ha⁻¹ between blocks, and 4.41-18.88%, 1.48-1.53 g cm⁻³, 0.133-0.324%, 6.08-14.20 and 5.73-9.72 t ha⁻¹ respectively between land uses indicated strong spatial rather than land use effects. Spatial variation in annual rainfall and soil characteristics lead carbon stock in order: Baitu < Baap < Sankara < Sanchor < Bali < Abu Road among blocks, whereas overgrazing, organic manuring and vegetation status controlled land use order like roadside < fallow land < pastureland < agriculture < or an < forest land. Though varied between blocks and land uses, non-significant decrease in gravel and increase in BD during 2013 to 2017 indicated increased soil compactness. Thus increased rainfall/soil water and vegetation status favored soil carbon storage. Enhanced vegetation in forest, oran and pastureland, organic manuring of agriculture and avoiding overgrazing of pasture/rangelands can promote soil carbon sequestration and reverse the process of land degradation and improve land productivity.

Key words: Carbon stock, land use, soil properties, spatial variations.

High climatic variability has its impact on all ecosystems, regions and sectors, but the nature and extent of vulnerability to the climate change differs with adaptive capacity of the individual, society and region (Singh and Kumar, 2015). The regions with scarce resources are among the most vulnerable systems and such regions exist in extreme climatic conditions like deserts and snow covered areas. The vulnerability of arid regions is accentuated by low levels of socio-economic development leading to fast depletion of available natural resources including soil and water (Mittal and Gupta, 2015). Along with high population density climate variations is enhancing the risk of degradation of soil, water and other natural resources affecting their effective usage for livelihoods support (Kundu *et al.*, 2016; Olofsson, 2017).

The increasing variability in weather pattern in western part of India could impose both

positive and negative impacts on agricultural and rangelands (Rao and Purohit, 2013). Some land use practices can degrade the quality of soil, waterway, air and other natural resources (Jamal *et al.*, 2016). More than 70% of the world's poor are living in rural areas, with land use as a major source of subsistence. Improving the productivity of these lands is essential for increasing the incomes and food security among the rural population (Chitonge, 2013). Forests, agriculture, pastureland, human habitations and various economic activities are different land use types and all are under varying degree of degradation affecting people livelihoods (Kundu *et al.*, 2016). While gross cropped area, cropping intensity and area under non-agricultural uses increased significantly in Rajasthan in recent years, the area under pasture, barren and uncultivable land and culturable wasteland has declined and are becoming overcrowded due to increasing livestock population (GoR, 2012). Farmers

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