J.Natn.Sci.Foundation Sri Lanka 2020 48 (4): 379 - 396
DOI: http://dx.doi.org/10.4038/jnsfsr.v48i4.8814

RESEARCH ARTICLE

Optimising usage of salinized lands in the lower part of the river basin for the coastal community in Bentota, Sri Lanka

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Submitted: 22 January 2019; Revised: 06 [illegible] 2020; Accepted: 29 May 2020

Abstract: Land degradation in coastal areas due to seawater intrusion, and coastal salinity is one of the major critical problems affecting the sustainable development of Sri Lanka. Coastal salinity risk is increasing in the Bentota area while diminishing land productivity which results in poor food production and giving rise to several socio-economic issues for the community in the area. Bentota is below the agricultural production capacity level and no strategy has been implemented or introduced so far regarding the utilisation of degraded lands in the area. This study identified the optimised extent of salinized lands for paddy, coconut, vegetables, fruits, tea, rubber and cinnamon cultivations based on future coastal salinity effects, land use demand and the development trend of the area. Land use change, rainfall, temperature, topography, floods, soil, ground and surface water are the factors applied in evaluations of land use suitability as the prior requirement for land use optimisation. Future demands of land use were predicted applying population growth models, the theory of land carrying capacity and the ecological footprint. Strategies for optimising the productivity of salinized lands were identified using a stakeholder perception-based approach. The developed sustainable land use pattern will enhance the land productivity of highly (3.4 %), moderately (39.6 %) and slightly (57 %) salinized areas in Bentota. Identified land management strategies will facilitate the spatial planning of future land use of this area by providing guidance to the local authority in the process of allocating salinized lands for enhancing land productivity.

Keywords: Future demand analysis, land use pattern, linear programming model, population forecasting, optimising salinized lands, seawater intrusion

INTRODUCTION

Coastal ecosystems are among the most economically productive areas and densely populated regions in the world (Barbier, 2012). Coastal surface water bodies hydraulically linked to the ocean are subject to seawater intrusion at varying levels. Saltwater intrusion (SWI) into freshwater coastal rivers and aquifers has been and continues to be one of the most significant global challenges for coastal water resource managers, coastal city planners, industries and agriculture (Ferguson & Gleeson, 2012). There are many factors that can influence the dynamic equilibrium between freshwater and sea water and contribute to SWI in a coastal aquifer (Costa, 2008). These influences include both natural variations and anthropogenic activities. The natural factors include climate change and sea-level rise, groundwater extraction and recharge, aquifer hydraulic properties, tidal exchange, rainfall, prolonged drought and the effect of gravitational forces (Costa, 2008; Williams, 2010; Werner *et al.*, 2013). Many activities of economic development such as agriculture, fisheries, industries, human settlement and transportation make significant impacts on the mechanics of SWI (Costa, 2008). Han *et al.* (2010) showed the vulnerability of Sri Lanka as an island to the effects of sea level rise in near future, which will be on average +12 cm per century. Taking precautionary steps for the now foreseen threats is highly important because Indian Ocean sea-level rise affects the

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