Assessment of land use and land cover changes and valuation of carbon stocks in the Sergipe semiarid region, Brazil: 1992–2030

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ABSTRACT

The semiarid region in the state of Sergipe, Brazil, approximately $11{,}000\,\text{km}^2$, has experienced high deforestation rates in the last decades, which ultimately contribute to global climatic changes. The valuation of ecosystem services of CO_2 sequestration can support definition of environmental policies to decrease deforestation in that region. This study aimed to assess land use and land cover changes in the Sergipe semiarid region between 1992 and 2017 by applying remotely sensed data and technics; simulate the land use and land cover changes between 2017 and 2030 by applying a cellular automaton model, by assuming current land use trends (Business as Usual – BAU) as a reference scenario, and a more conservative scenario (Protected Forest – PF), in which was assumed an effective enforcement of the Brazilian Forest Code established in 2012; simulate the carbon stocks by 2017 assuming the BAU and PF scenarios by 2030, and estimate the Carbon balance between the 2030 and 2017 scenarios; and estimate the economic valuation of carbon emission and sequestration by using the InVEST software. The results showed that agriculture (cropped lands) was main driver of the landscape changes in the study area, which increased 14% by 2017, a net increase of $1494.45\,\text{km}^2$. The results showed that the total Carbon emissions would reach $736{,}900\,\text{Mg}\,CO_2$-eq by assuming the BAU scenario, which would increase the cost of opportunity up to US\$ 17.7 million and a social carbon cost varying between US\$ 10.3 and US\$ 30.2 million. The restoration of the permanent preservation areas could contribute to increase Carbon sequestration up to $481{,}900\,\text{Mg}\,CO_2$-eq by 2030, which is equivalent cost of US\$ 11.6 million. The natural landscape in the Sergipe semiarid region was strongly affected by deforestation activities occurred between 1992 and 2017. It requires, therefore, effective actions to support and promote restoration of degraded areas. The forested areas within the Sergipe semiarid region were the most affected type of vegetation because of expansion of agricultural fields soil exposures (*Exposed Land*). Environmental assessments based on scenarios and economic valuations can provide crucial information to support policy and decision makers to improve strategies for environmental management and conservation.

1. Introduction

Deforestation is an important source of greenhouse gas (GHG) emission. It has been estimated that 47% of the accumulated emissions since 1750 is due to the deforestation (Le Quéré et al., 2015). A decreasing deforestation rate has been observed in tropical regions in the last decade (Keenan et al., 2015), although those regions are the main source of GHG emissions (Le Quéré et al., 2015). GHG emissions in Brazil reached 2 billion $\text{Mg}\,CO_2$-eq (carbon dioxide equivalent) in 2017, which levered the country to the seventh largest global GHG