



Climate change impacts on the sustainability of the firewood harvest and vegetation and soil carbon stocks in a tropical dry forest in Santa Teresinha Municipality, Northeast Brazil [☆]



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ABSTRACT

The Brazilian semi-arid region is characterized by low and erratic rainfall, high temperatures and high potential evapotranspiration. The removal of firewood from the native tropical dry forest, called “Caatinga”, can negatively impact important ecosystem services, such as soil conservation, water resources, biodiversity and atmospheric carbon capture, if performed in an unsustainable manner. Most global climate models indicate that Caatinga will experience temperature increases and rainfall decreases in the next few decades. We used the Century model to simulate the impact of climate changes on woody vegetation growth and on vegetation and soil organic carbon stocks in a Caatinga area managed with a single clear cut or cuts every 10 years, 15 years, and 20 years, followed or not followed by the burning of plant residues (leaves and small branches) left after firewood removal. The effects of future climate projections, (LOW, MIDI and HIGH members of the climate scenario SRES A1B, which corresponded to different CO₂ emission predictions, downscaled by the Eta/CPTEC model), were compared to those of the projection of the historical climate. With the current climate, it would take 50 years to regenerate the Caatinga biomass stock to a level close to that before cutting after a single cut, followed or not followed by fire. Therefore, the recommended cutting cycles (10–20 years) were not long enough to allow for the regeneration of a fully mature Caatinga. However, all of these cycles reached sustainable biomass production levels, with similar total productions until the end of the century. Under these conditions, the lower proportions of biomass recovery of shorter cycles would be compensated by more frequent cutting. The model also indicated that burning or not burning the residues would have little effect. On the contrary, if the climate changes as predicted, the biomass of the native Caatinga vegetation and soil organic carbon stock would decrease throughout this century, even without cutting the vegetation. All of the cutting cycles would not provide sustainable firewood production, with reduced production after each consecutive cut. Therefore, if the climate changes as expected, forest management legislation should require longer periods of forest recovery between cutting cycles for sites with environmental conditions (e.g., climate, soil and vegetation) similar to those of the present study.

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1. Introduction

The native tropical dry forest of the semi-arid region of Northeastern Brazil, called “Caatinga”, originally occupied an area of

nearly 1 million km² (Brasil, 2007). Natural fires are rare in the Caatinga vegetation (Sampaio, 1995; Gariglio et al., 2010), but burning is part of the three main production systems: firewood production, cattle production on native pasture and slash and burn

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