

Chapter 7

Floristic Diversity and Carbon Stock in the Dry Forests of Chad:

The Case of Manda National Park – Diversity and Carbon Sequestration of the Manda National Park Flora

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ABSTRACT

The woody flora of the National Park of Manda in the Sudanian area of Chad has been characterized between October and December 2016 to know its floristic diversity, and to quantify its aerial woody biomass. The transect and quadra method (1m x 1m) were simultaneously adopted for this study. The pan-tropical equation of Chave et al. made it possible to evaluate the carbon stocks in different sites. The study of the flora species identified 45 species divided into 37 genus and 21 families for an average population density of 355 individuals/ha. Three classes of the diameter dominate the settlement: class ≤ 10 cm; class of 10-20 cm and class of 20-30 cm. The height classes belong to the class of plants ≤ 4 m; and at last having a height ≤ 7 m. The basal area was $5.86 \text{ m}^2 / \text{ha}$. It appears that the woody components store $23.82 \pm 0.01 \text{ tC} / \text{ha}$, the undergrowth $0.14 \pm 0.01 \text{ tC} / \text{ha}$ and the litter $0.56 \pm 0.01 \text{ tC} / \text{ha}$. This research is a contribution to the REDD+ process (Reducing Emissions from Deforestation and Forest Degradation).

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INTRODUCTION

Central African countries are in a process of integrating the reduction of greenhouse gas (GHG) emissions from the forest sector into their national policies, including the promotion of measures (compensation for environmental services) to encourage the conservation of forested areas (Banoho, 2014). These forests which are considered as lungs of the planet are very threatened by the effects of climate change in comparison to tropical forests around the world (Zapfack, 2005). In addition to the world's tropical forests and those of Central Africa, there are savannas and steppes that are vulnerable areas (Ngomanda et al. 2013).

Chad, where more than half of the geographical area is desert, has a flora threatened by the creation of agricultural land, the extension of cities, the search for firewood, pastoral pressure, etc (Ouya, 2010). These activities are responsible for desertification and food insecurity (Bertrand & Lagnaba, 2011) which lead into a decrease in biological diversity and promoting the appearance of invasive species (Saradoum et al. 2012). In order to conserve the large biodiversity areas around the country, Chad has opted for the development of a network of Protected Areas (PA) consisting of 30 forest entities classified and representing an area of **15,787,200 ha** or the 12. 3% of the national territory (Worgue, 2012).

Manda National Park (MNP) is part of this PA network (Kolmagne, 2000). This PA network initiative is very significant knowing that that between 1990 and 2000, the annual deforestation rate determined by FAO for Chad was 0.6% per year (Ouya, 2010).

Very few studies has been undertaken in the Manda National Park (MNP) which is very rich in terms of natural resources, faunal and floristic diversity (Saradoum et al, 2012). However, its flora, well preserved till present, is under the threat of urbanization of the third city of Chad: Sarh (Ouya, op.cit).

In tropical forest ecosystems, carbon is stored in different reservoirs, including plant biomass and soil (Asase et al. 2008). Studies to date on the assessment of carbon stocks in the Congo Basin forests did not include savannas and steppes in the Sudano-Sahelian zones. This study aims to fill this knowledge gap and to bring current knowledge on woody biodiversity and the capacity of these environments to store carbon.

The goal of this study is to determine the floristic diversity of the MNP as well as to evaluate the carbon stocks. This work is part of the process that contributes, on the one hand, to the evaluation of sequestration by the MNP flora, with a view to identifying the orientations aiming to reconcile the conservation and the rational use of natural resources, and on the other, to acquire bases that will facilitate the inscription of the MNP in the REDD+ process.

MATERIAL AND METHODS

Introduction of the Study Area

The MNP is located at 25 kilometers in the North West of the city of Sarh in the Department of Barh Kôh, Region of Moyen-Chari, about 450 km in the South East of N'Djamena, and 80 km from the Central African border. It is between latitude 9°20' and 9°35' in the North and longitude 17°45 'and 18°20' in the East; its altitude varies from 344 m to 691 m (Figure 1). With an estimated area of 1,14,000 ha, this protected area is located in one of the most populated areas of Chad, with a density of 21.8 inhabitants/km in the four peripheral cantons of the MNP (Zouglou, 2010). The population of these four cantons

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