DESERTIFICATION OR REGREENING? MULTI-SCALE STUDY OF VEGETATION COVER EVOLUTION IN AFRICAN SAHEL FROM REMOTE SENSING DATA

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ABSTRACT

This article presents some of the results and conclusions of a PhD thesis entitled *"Désertification ou reverdissement ? Étude multiscalaire de l'évolution du couvert végétal en Afrique Sahélienne à partir de données de télédétection* » completed by the author (San Emeterio, 2015).

The purpose of this work was to shed some light on the land degradation debate in the African Sahel using remote sensing approaches. While this topic has been widely discussed during the last decades, there is still a lack of consensus on the best ways for assessing this phenomenon. The vegetation cover being closely related to land degradation its evolution has been frequently used to understand land dynamics.

KEYWORDS

Sahel, Niger, desertification, land degradation, regreening, remote sensing, multi-scalar approach, vegetation cover, NDVI, rainfall.

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1. INTRODUCTION

Land degradation touches mainly arid, semi-arid and sub-humid regions that account for 40% of the emerged planet's surface and where more than 1 billion people live. It reduces land productivity and food resources, increases populations and ecosystems vulnerability and can have an impact on global climate.

The 70s and 80s knew humanitarian crises in the African Sahel that were triggered by unequalled droughts during this period. These events clearly contributed to putting this region in the international spotlight and helped to raise awareness of land degradation problem since the 70s (Veron *et al*., 2006). Some studies pointed out then to an irreversible and advancing desertification in the whole region (Lamprey, 1975). However, the return to wetter conditions in the 90s led to revising previous evaluations and a regreening narrative emerged (Nicholson *et al*., 1998; Prince *et al*., 1998). Since then some contradictory results have contributed to nuancing this point making it difficult to pronounce a definitive diagnostic at a regional scale (Hein & De Ridder, 2006; Hountondji *et al*., 2006; Bai *et al*., 2008; Wessels, 2009; Fensholt & Rasmussen, 2011; Dardel *et al*., 2014).

Since the 80s remote sensing techniques have permitted a continuous global monitoring of vegetation productivity, especially thanks to the NOAA satellites. As land degradation often involves a loss in biological productivity the trends of vegetation indexes have been frequently used as an indicator of land condition.

To account for the high interannual climatic variability it is necessary to use indexes that integrate annual rainfall such as RUE (Rain Use Efficiency) (Le Houérou, 1984) or RESTREND (Evans & Geerken, 2004). The final aim of these indexes is to separate the climate and human component from observed vegetation productivity trends.

Initially the main questions to be answered were: which is the best method for monitoring land degradation on a regional scale? How can a regional monitoring account for environments that are very heterogeneous when observed at finer scales? What is the current situation in the African Sahel concerning land degradation? Has there been a regreening since the 90s? What is the relative importance of climate and human components on the observed trends?

This work resulted in a multi-scale vegetation cover evolution analysis from a regional scale, including the entire Sahelian band, to a local scale, including some hotspots of land degradation.

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