Research Application Summary

Spatial dynamic of the Mabalane Mopane ecossytem degradation and its association with wildfires in southern Mozambique: What implications for biodiversity and people's livelihoods

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Abstract

The study focused on the Mopane woodlands, a forest ecosystem in Mozambiques from which the rural poor extract various forest and non forests products. The size of the ecosystem has been reduced over the years due to extensive agriculture practices involving slash and burn, and therefore needs to be protected. However, for this to be done, there must be evidence linking inappropriate practices and forest degradation. In this study, the Mopane ecosystem degradation will be assessed by spatial dynamic analysis and its relationship with wildfires for the period 1989 to 2011. This will be conducted using remote sensing and GIS techniques combined with thematic maps and field work for verification. Landsat TM satellite 30m resolution images will provide data for the study period. Results will include mapping of the Mopane forests by levels of degradation. The role of wildfires on the forest ecosystem degradation and other edaffic factors will also be determined. . In addition, the impacts of such events on rural community livelihoods will also be assessed.

Key words: *Colophospermum,* forest degradation, Landsat images, livelihoods, Mopane, wildfires

Résumé

L'étude a porté sur les régions boisées de Mopane, un écosystème forestier au Mozambique à partir duquel les pauvres paysans tirent les divers produits forestiers et non-forestiers. La taille de l'écosystème a été réduite au fil des années suite aux pratiques agricoles extensives entre autre l'agriculture sur brûlis, et doit donc être protégé. Toutefois, pour que cela soit fait, il doit y avoir une évidence montrant la liaison entre les pratiques inappropriées et la dégradation des forêts. Dans cette étude, la dégradation de l'écosystème de Mopane sera évaluée par une analyse de la dynamique spatiale et sa relation avec les incendies de forêt pour la période de 1989 à 2011. Cette enquête sera réalisée en utilisant les techniques de télédétection et de

SIG combinées à des cartes thématiques et le travail sur terrain pour la vérification. Les images de 30m de résolution du satellite Landsat TM fourniront des données pour la période d'étude. Les résultats seront notamment la cartographie des forêts de Mopane par des niveaux de dégradation. Le rôle des feux de forêt sur la dégradation des écosystèmes forestiers et d'autres facteurs édaphiques seront également déterminés. En outre, les impacts de tels événements sur les moyens de subsistance des communautés rurales seront également évalués.

Mots clés: *Colophospermum*, dégradation des forêts, images Landsat, moyens de subsistance, Mopane, feux de forêt

Background

In Mozambique, people depend on natural resources and forests in particular especially in rural areas where poverty levels are high. MICOA (2008) reported a positive geographical association between poverty incidence and human pressure on natural resources and loss of biodiversity which in turn endangers peoples´ livelihoods. The Mopane woodlands constitute the second largest forest ecosystem in the country with largest occurrence in central (Tete Province) and southern parts of the country (Inhambane and Gaza Provinces). Consequences of human activity on this natural resource has not yet been quantified, nor its implications to welfare of affected communities.

Literature Summary

Several products are extracted from the Mopane woodlands. These include charcoal, fire wood, building materials, fodder, medicinal plants, fruits and meat from some animal species and other foods. The District of Mabalane in Gaza, with poverty incidence of 80% is home to extensive Mopane woodlands, an area that has been shrinking over the years (Cumbane, 2010; MICOA, 2011). This is the driving force behind the opening new agricultural lands every year, unsustainable agricultural practices involving slash and burn among other human activities. It has been reported that wildfires are responsible for forest degradation in the tropics and about 20% of the Greenhouse gas emissions thus contributing to climate changes (World Bank, 2010). According to the World Bank (2010) report, the most frequent climate related extreme events in southern Mozambique is drought and socio-economic impacts associated with climate change and perceived by rural communities to include water scarcity, forest productivity and migration. This study was carried out to determine sustainable forest resources

use, extraction levels and alternative income generation activities to avoid further depletion of forest resources.

Study Description

The study is being conducted in the Mabalane District, Province of Gaza (23°37'60 S; 32°31'0E), covering an area of 9,107 km^2 and inhabited by approximately 25,464 people. The economic activities of these people mostly comprise subsistence farming and extraction of forest products (MAE, 2005). The first phase of the study comprised imaging using historic Landsat TM images from National Centre of Remote Sensing and Cartography database (Centro Nacional de Cartografia e Teledeteccão e outras baixas do http://glovis.usgs.gov/) for the period 1989 to 2011. The images were processed and classified using "*Unsupervision Classification"* method combined with visual interpretation for validation. The thematic maps enabled classification of land cover and land use units as defined by the Integrated Assessment of Forests in Mozambique (Marzoli 2008) along the study period and to estimate the corresponding areas by statistical analyses of vegetation changes. Using 1989 as the baseline yea,r three degradation levels were determined namely: high (where changes occurred from dense Mopane forest to agriculture areas - less than 10% cover); moderate (where changes occurred from dense Mopane forest to open forest) and low or nil (where more than 90% of the area remained classified as dense Mopane forest). In addition, fire regime components were estimated specifically the extent of burnt areas, fire frequency, season and intensity. The data on fire regime will be assessed against forest degradation in order to understand any relationship between the two variables. Causes of wildfires and potential impacts on peoples´ livelihoods will be investigated by conducting socio-economic surveys. Current vegetation structure, composition and biodiversity will also be described in different Mopane forest degradation levels using transects and sampling plots along transects set up over degradation gradient.

Research Application

The three Mopane vegetation degradation zones tend to vary in time (Figures 1 and 2). A total of 459 fire events occurred during the period 2002 to 2011. Fire frequency was more predominant in patches throughout the region.

In the last 20 years, there was an 18% increase in undisturbed vegetation although the ecosystem with moderate degradation increased by more than 64%..

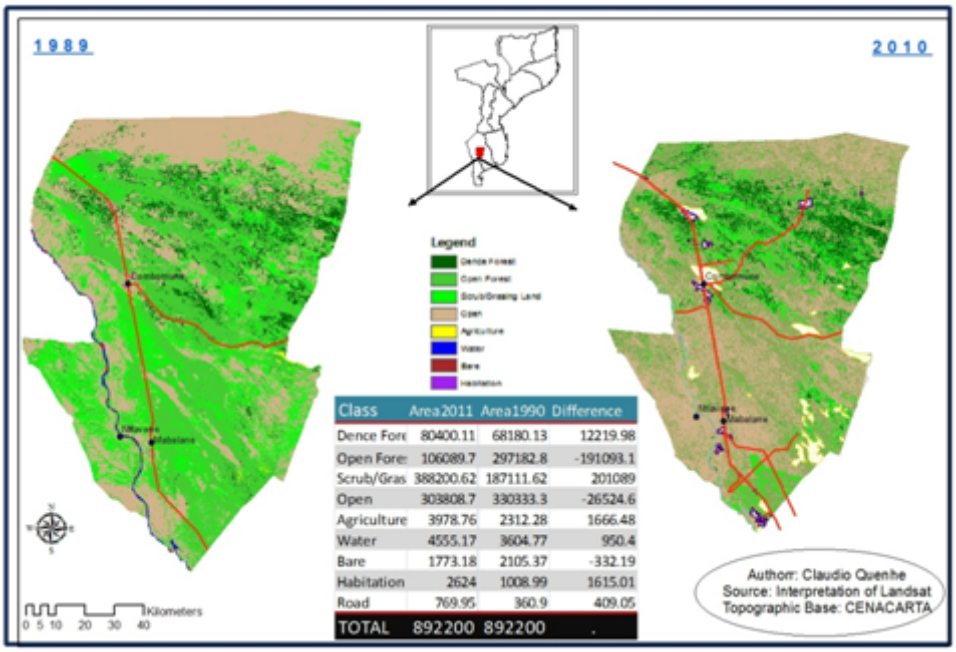

Figure 1. Changes of land use and land cover in the Mabalane District during 20 years (1990 to 2010).

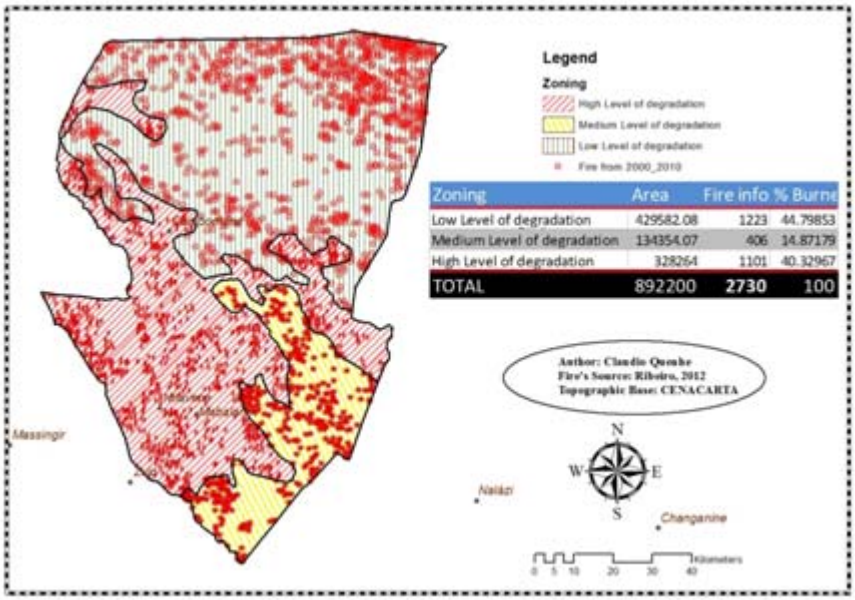

Figure 2. Zoning of the forest ecosystem degradation levels and its relationship with wildfires.

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