AN ATTEMPT OF DELIMITATION AND CHARACTERIZATION OF PYROREGIONS IN CAMEROON, USING DATA DERIVED FROM LOW RESOLUTION SATELLITE IMAGERY

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ABSTRACT

In the current context of promoting sustainable development, the issue of managing vegetation fires has become worrying and involves many issues related to climate change, environmental degradation and civil protection. In Cameroon, the regulatory provisions on fires practices, mainly restrictive, have been mostly ineffective because they are not based on reliable indicators of monitoring the phenomenon over time and space. In fact, the determination of the period of so-called "early" and tolerated fires relies on very static variables such as the beginning of the dry season, calculated over a long series of rainfall data (20 years and more). However, the beginning and severity of the fire season can vary significantly from year to year, especially in the current context of climatic variability. Furthermore, Cameroon's commitment to climate stabilization mechanisms initiated at the international level requires timely data on greenhouse gas emissions, much of which are derived from biomass burning in sub-tropical Africa.

In short, figures on the distribution of wildfires are necessary to better enforce the regulations. However, this distribution is variable, both seasonally and annually, depending on vegetation type, land use patterns, and climate cycles; this further complicates the assessment of the actual frequency of fires throughout the territory. The formulation and implementation of a fire prevention plan requires consideration on fire's history in terms of location, seasonality and social justification.

Attempts to monitor fires through field campaigns have shown their limitations because of the ephemeral nature of the vegetation combustions and the inaccessibility of some affected areas. The objective of this contribution is to characterize Cameroon's pyroregions using data from low-resolution imagery, to support the implementation of wildfire regulations. For the monitoring of a phenomenon as ephemeral and repetitive as wildfires, the satellite imagery approach has the advantage of offering a wide view and a certain repetitiveness of the observations making it possible to evaluate the phenomenon on various scales of time and space.

Active fire pixels covering part or the whole globe are produced from low spatial resolution satellite imagery and used by different regional or global initiatives. The comparison of the different series available (MODIS active fire, ATSR, NOAA-AVHRR, TRMM-VIRS), however, revealed significant statistical differences. **Table 1** presents the correlation coefficients between the series. It therefore becomes necessary to carry out, before use, their validation using high spatial resolution imagery (LANDSAT TM or ETM). For this purpose, eight Landsat ETM scenes covering different ecosystems were acquired (**Plate 1**). Three color composites 6-5-3 confirmed the potential of Landsat imagery in highlighting the spaces affected by fires (**Plate 2**). The confrontation of the Landsat fire zones and the low spatial resolution data made it possible to validate the MODIS active fire pixels as the best adapted to the monitoring of vegetation burning in Cameroon, with a statistic precision of 62%. Daily MODIS active fire data for the period from 2001 to 2010 were compiled by decade and spatialized. After conclusive correlation tests between explanatory variables and fire occurrences, the Principal Component Analysis ultimately structured the fire zone in the Cameroonian territory.

The distribution over time of active fires indicates that the season of vegetation burning in Cameroon goes from October to April, with peaks in December. There is also, over the months, a North-South and then, South-North shift of the fire concentration zone (**Plate 3**). The analysis of the factors of regionalization of the fires shows a direct and preponderant influence of the vegetation taken in its nature, its density and its state of humidity (**Plate 4**). In the south, the fires follow the margins of the forest, always too wet to favor the extension of the flames. The rare fires observed are mainly related to agricultural clearance (**Table 2**). They thus appear as

indexes for identification of degraded forests. It is in Sudanian zone that the fires are the most numerous and spread over time. Here, the abundant and conducive vegetation allow the spread of fires in the dry season. In the Sahelian zone, only the flooded *yaere* carries dense herbaceous vegetation that can feed large fires up to the heart of the dry season. Elsewhere, the scarcity of grass cover due to climatic aridity and livestock harvesting hampers the spread of fires. Histograms of active fires observed in main vegetation units are displayed at **Figure 1**.

Based on the fire density, the beginning and the spreading of the fire season, the Cameroonian territory is subdivided into 8 pyroregions (**Plate 5**), whose characteristics can be taking into account to reduce significantly the inconsistencies observed in the implementation of regulations provisions on fires practices. This partition of the space into pyroregions also constitutes an initial framework, in which more detailed observations can be carry out in order to evaluate more precisely the emissions of Greenhouse gases resulting from vegetation burning.

KEYWORDS

Vegetation fires, environmental regulation, satellite data, pyroregion, Cameroon.

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