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BIOPHYSICAL FACTORS OF FLOODING IN THE COMMUNE OF LALO

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Abstract
Flooding in the Lalo Commune is increasing over time and creating real damage to the people. They transform them into "climate refugees" in their own commune. Several biophysical factors explain these floods in the Municipality of Lalo. This research presents the biophysical factors explaining the vulnerability of human settlements to floods in Lalo Commune.

The approach adopted was the collection of data, their processing and the analysis of the results. Hydro-climatological data for the period 1981 to 2016 were used. The evolution of monthly rainfall regimes is known, thanks to the systemic approach that combines graphical method and frequency analysis.

For 80% of respondents, precipitation is the first physical trigger of flooding in the municipality of Lalo. Then, 70% argue that the proximity of the Couffo river fields leads to a flood due to the overflow of the river (flood). Thus, the increase in river flows is considered the second most important physical factor of flooding in Lalo. In third place, it is the nature of the soil which explains the floods in the Municipality of Lalo (79% of the respondents). The lack of vegetation cover is one of the significant elements in the biophysical vulnerability factors of human settlements to floods in Lalo Commune.

Keywords: Lalo commune, biophysical factors, inundation

1. Introduction and justification of the subject

Floods are a major risk globally, and also in Africa. At the forefront of natural disasters in the world, they claim about 20,000 lives each year (LACEEDE, 2010). These disasters result from periodic natural phenomena such as the monsoon or el niño, others are the result of particular circumstances (cyclones, typhoons, violent storms) and are aggravated by the climatic disturbances. No country, regardless of its level of development, is immune to these events (Dauphine, 2001 and Houndakinnou, 2005).

In Benin, for some decades, floods have occurred at a faster pace, causing significant human and material damage and potentially more devastating (Assogba, 2011). Floods represent a great danger for the entire society and, more particularly, for human settlements (Plan Benin, 2011).

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For example, rainfall disasters in 2010 significantly impacted human settlements with 53,613 houses destroyed, most of which were built with precarious local materials. In addition, 600 schools were destroyed, paralyzing the education of many children (Plan Benin, 2011).

In the municipality of Lalo, particularly in the localities near the rivers and lakes, the heavy rains, the water releases, associated with the inputs of the Couffo river, cause floods which cause more and more important damages. on crops and infrastructure (houses, attics, bridges, developed water points, roads, etc.).

This research investigates the biophysical factors that explain flooding in the Lalo Commune (Figure 1).

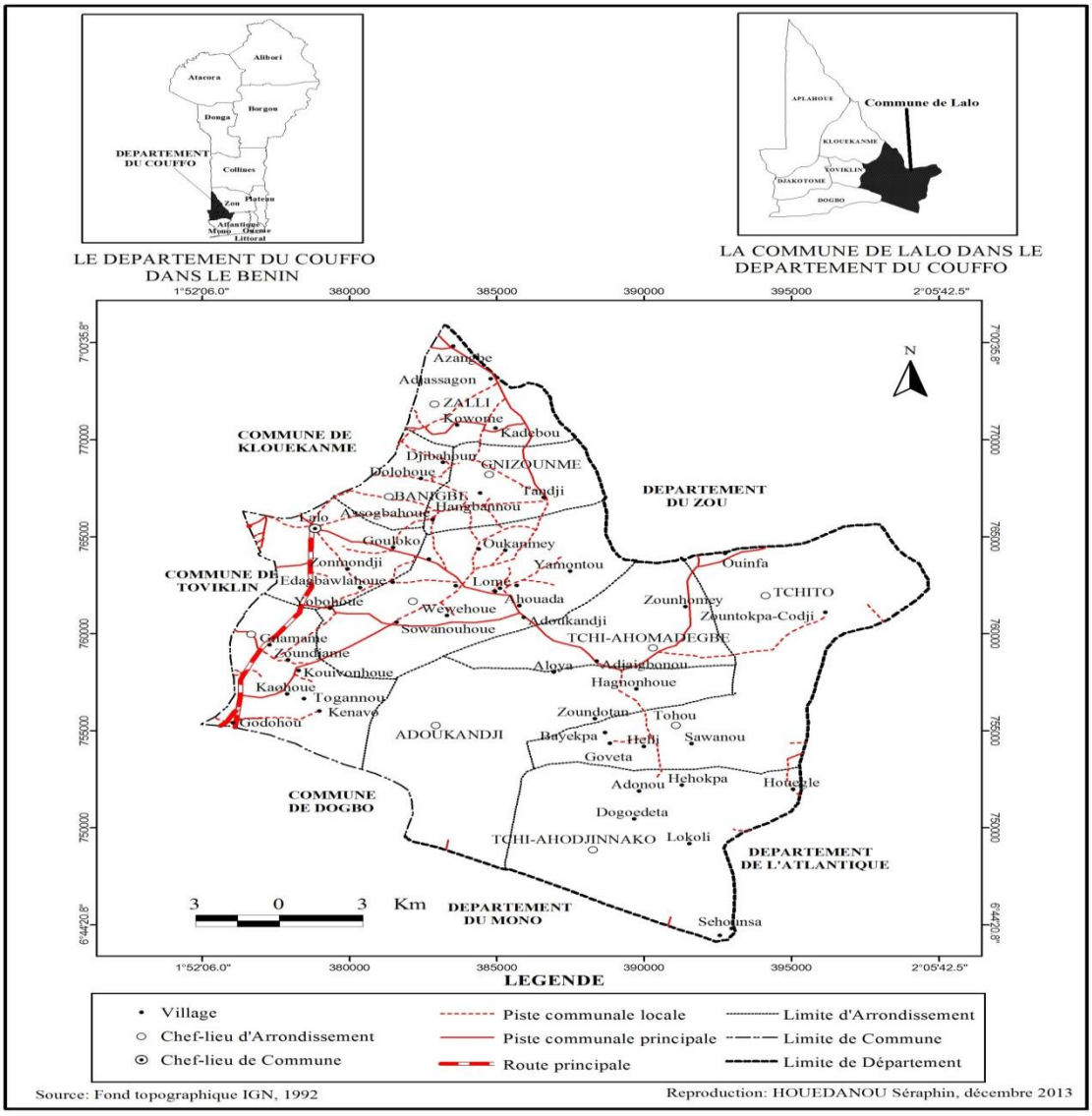

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Figure 1: Geographic and Administrative Situations of the Municipality of Lalo

2. Data and methods

Several data were used. This is the climatological data (rainfall heights over the period 1981 to 2016) extracted from the database of the Agency for Safety for Air Navigation in Africa and Madagascar (ASECNA); Datas

hydrological data on river flows Couffoextracts from the DGE database; data on vegetation and soil characteristics of Lalo Commune.

The arithmetic mean was used in the study of climatic and hydrological regimes on a series of data for climatic and hydrological characterization. The mean formula is as follows M = with M: mean, N: total number of modalities and Xi: modalities of the character studied. It allows the calculation of certain dispersion parameters. The standard deviation made it possible to study the dispersion of annual rainfall and hydrological precipitated values at the stations targeted in this study.

The cumulative number of rainy days (ΣXi), the spread of the seasons and the dry and rainy sequences of the series considered were determined. The diagnosis of the rainy and dry sequences was made from the analysis of the pluviometric indices on the chosen series and by station, determined from the formula Xi-Xmoy / σ where Xi is the variable studied for one year, Xmoy la average rainfall and σ the standard deviation of the series. In addition, trend curves based on rolling five-year rolling averages are used to identify dynamics in hydropluviometric variability.

In addition, the evolution of monthly rainfall regimes is known, thanks to the systemic approach that combines graphical method and frequency analysis.

3. Results

Several natural factors contribute to the vulnerability of human settlements in Lalo commune to floods. These are, among other things, the fluctuation of rainfall, the variation in the flow of the Couffo River, the low vegetation cover and the clay character of the soil.

3.1 Monthly Evolution Pluviometric

During the commune of Lalo, the pre-precipitation behavior allows the separation of seismic sections (December to March and August), with absence or insuffisance of rainfall (precipitations are below 40 mm, almost zero in December, January and February) and deux Rainy seasons (April to July and September to November), where you will find the best and most abundant (the average monthly life is 150 mm), as indicated in figure 2.

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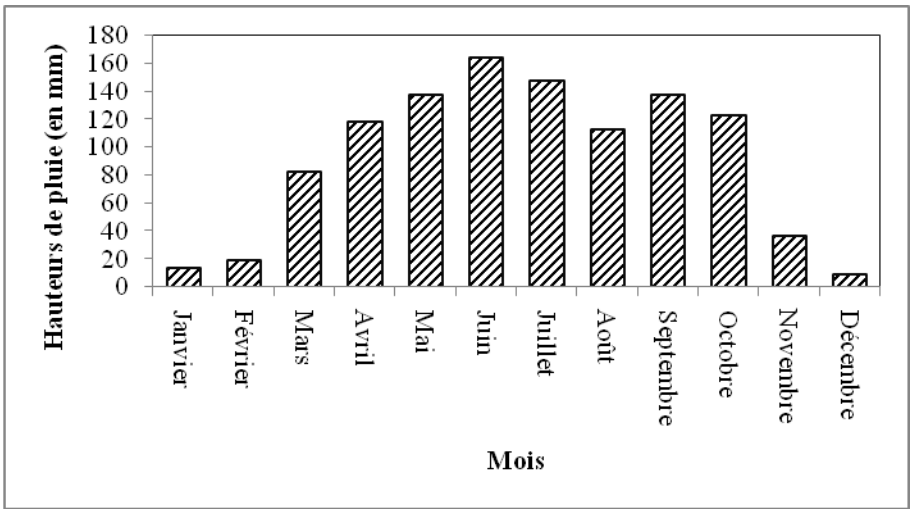

Figure 2: Rainfall regime in the municipality of Lalo

Data source: ASECNA, 2016

The analysis of Figure 2 shows that the rainfall regime is bimodal with two peaks of unequal importance. On a monthly scale, precipitation varies in intensity and is a source of serious disturbance, leading to flooding, especially at the end of the first rainy season when rainfall amounts reach their maximum. Indeed, the variation of rainfall over time and space is related to the influence of two winds such as monsoon and grain lines, precipitation varies in space and especially in time. The average annual rainfall is 1103 mm over the study period with a rainfall concentration of 51.5% during the first rainy season and 27% during the second rainy season (from September to November) .

It is during or near the end of these periods of high rainfall concentration occur floods.

In addition, the precipitated water trickles and contributes to the recharging of the water table (Figure 3).

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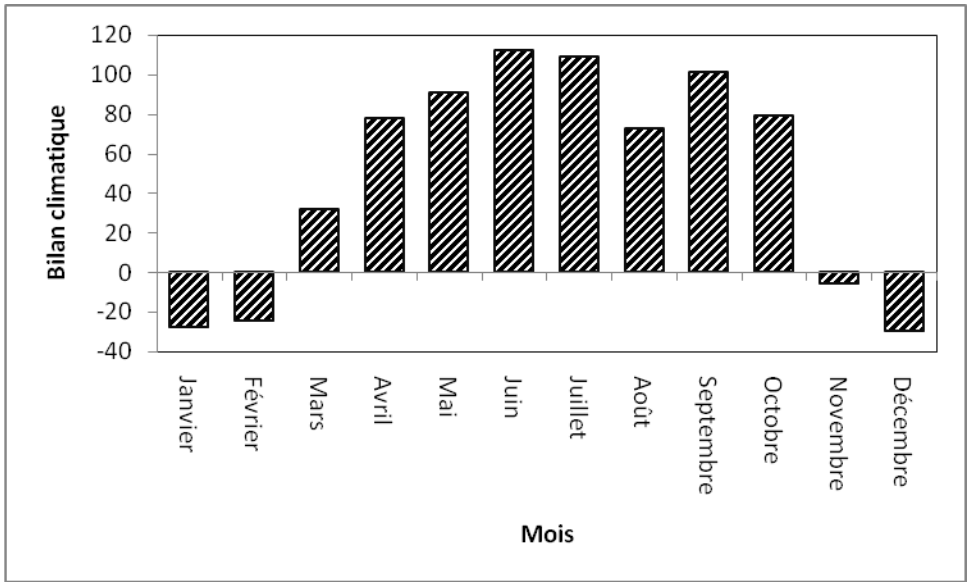

Figure 3: Monthly change in climate balance (1981-2016)

Data source: ASECNA, 2016

The analysis in Figure 3 reveals that the climate balance is overall positive except for the months of November, December, January and February when it is negative. The highest values are noted during the months of June, July and September when the infiltration of runoff becomes difficult and leads to flooding.

3.2 Monthly flow evolution

The hydrographic network of the Municipality of Lalo is denser in its eastern and north-eastern part. It is marked by the presence of the Couffo River and its tributaries over a length of 11 km. The ponds of Tandji and Oukanmè are sometimes influenced by the main course. This hydrographic network favors the occurrence of floods during the rainy season and consequently exposes riparian populations to the risk of flooding. Indeed, the overflow of the Couffo River causes floods with disastrous consequences. Figure 4 shows the variation of Couffo river flow on a monthly scale

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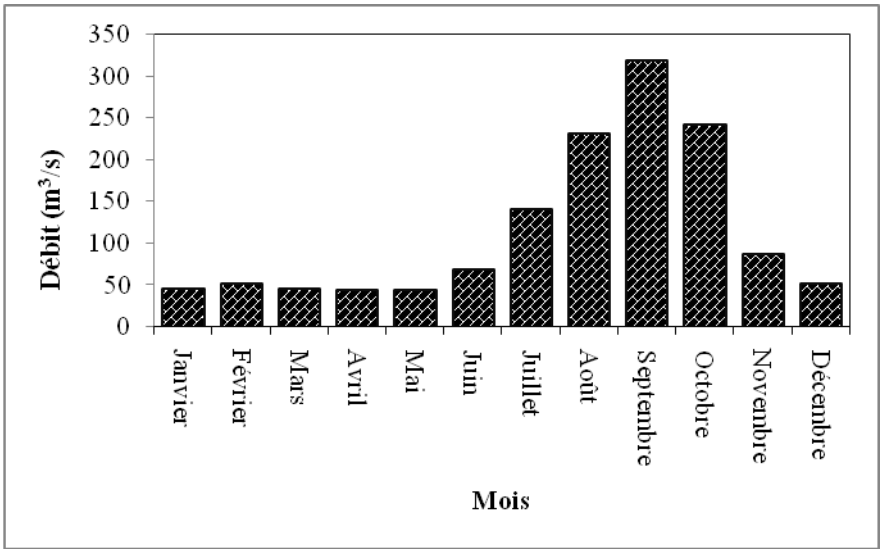

Figure 4: Monthly variation of the flow of the Couffo river from 1981-2016

Data source: DG-Water, 2016

The analysis in Figure 4 reveals that the regime of the tropical Couffo unimodal river is low (43.5 m3 / s) in the first months of the rainy season and maximum in September (319 m3 / s). The flow becomes truly significant from July when the flow is around 75 m3 / s. The months of August, September and October record a significant flow and it is during this period that the floods occur. This flow is supported by the rains of May and July and especially.

The explanatory factors for the overflow of rivers are modeled by Figure 5

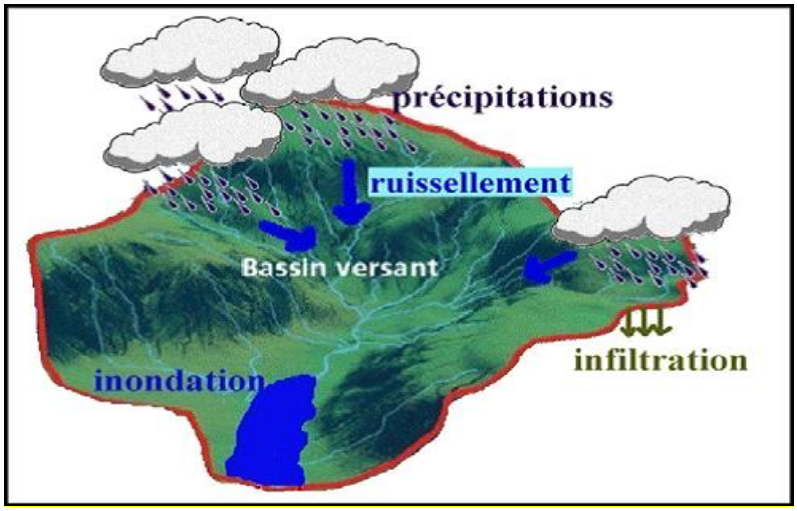

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Figure 5: Factors Involving the Overflow of a Watercourse

Source: Hostache, 2006

The analysis in Figure 5 shows that, according to the Hostache model (2006), precipitation, runoff and infiltration are factors determining the overflow of a watercourse. In fact, the precipitated water flows towards the watershed following the topographic slope. The infiltration power of water is dependent on the geological substratum and also on human occupation. When it is weak, there are floods that affect human settlements.

3.3 Impermeability of soils

Soil impermeability prevents the infiltration of rainwater that can no longer quickly reach the water table (which naturally plays the role of retention pond). These changes are a determining factor in the outbreak of floods in the municipality of Lalo. Figure 6 shows the pedological characteristics of the municipality of Lalo.

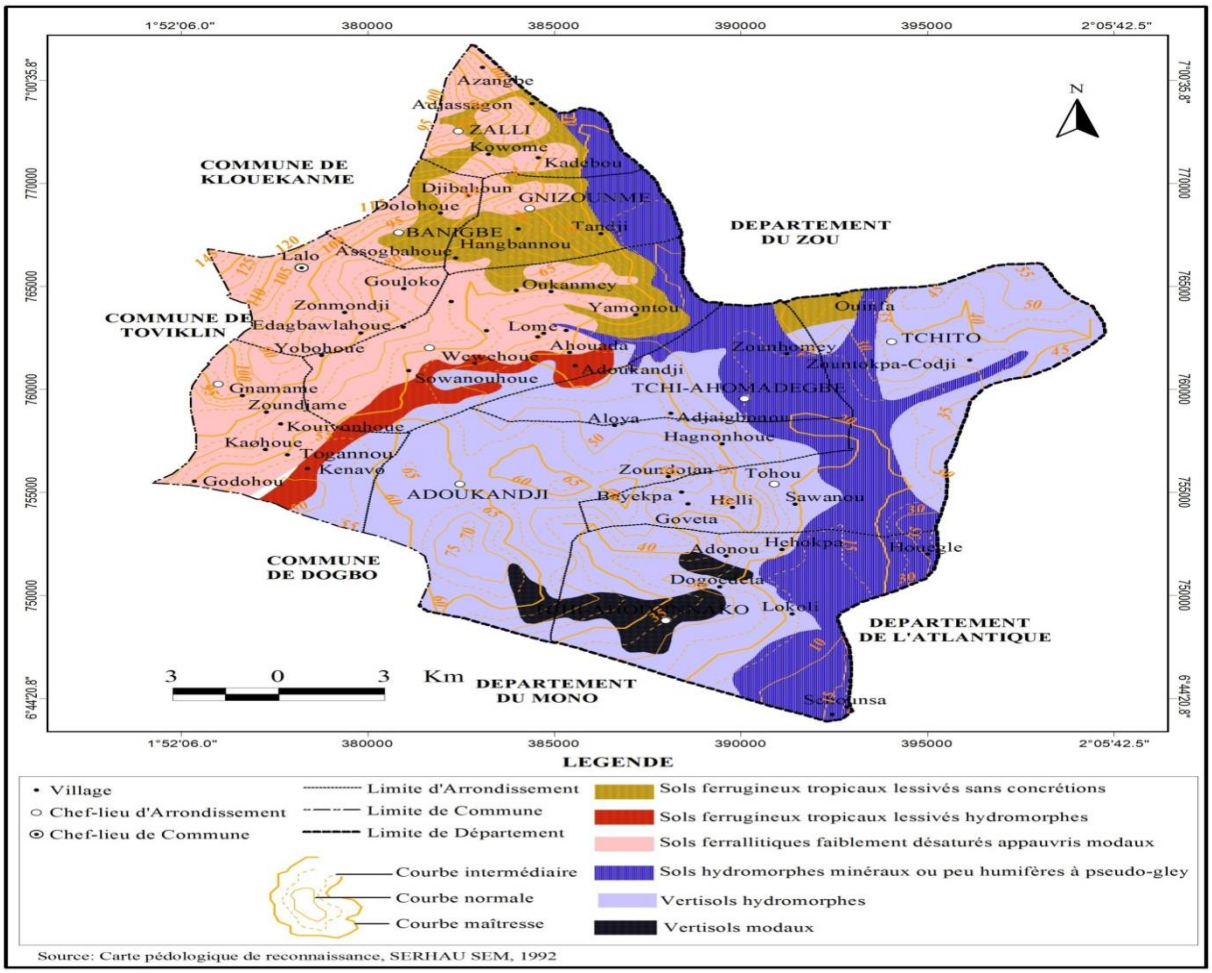

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Figure 6: Pedological and topographic characteristics of the municipality of Lalo

The analysis of Figure 6 reveals that the study area includes six types of soils namely tropical ferruginous soils without concretion, hydromorphous leached tropical ferruginous soils, modal impoverished low desaturated ferralitic soils, soils

Mineral or slightly humus hydromorphs to pseudo-gley, hydromorphic vertisols and modal vertisols. Soils found in the south-west are predominantly hydromorphic and hydromorphy is greater along streams. These soils have a low infiltration capacity and are engorged with water in case of repeated rainfall. Vertisols become difficult to access due to the dominance of clay

3.4 Degradation of vegetation cover

Vegetation cover (forest, wood) helps slow the movement of water. Leaves and other organic matter found on the ground absorb rainwater and gradually release it to the soil below. The water resurfaces much later in springs that feed the streams favoring the infiltration of water thanks to their roots, and the evapotranspiration thanks to their foliage (LACEEDE, 2010).

In the municipality of Lalo, the vegetation cover is deteriorating due to the intensification of agricultural activities. Trees are destroyed in favor of fields and houses. This state of affairs does not allow a good infiltration of water in soils already clayey and low infiltration capacity.

Conclusion

The floods in the municipality of Lalo are mainly related to climatic factors, including rainfall. In addition to these factors, soils are predominantly hydromorphic with a low infiltration capacity and therefore engorged with water in the event of repeated rainfall. In addition, the degradation of the vegetation cover because of the intensification of agricultural activities does not allow a good infiltration of water in soils already clayey and low infiltration capacity. In addition to the biophysical factors, the human factors including the anarchic occupation of the spaces explain the amplification of the floods in the Municipality of Lalo.

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