International Journal of Computer Engineering and Sciences Research

VOL. 01, NO. 02, July-August 2019
Pages 01–08
Available online at: www.ijcesr.com

Erosive process of formation of ravines in Saurimo city and its environmental consequences.

[1]Blanca Margarita Guerrero Haber
[2]Francisco Martins
[3]Zoe Alés López
[4]José Venancio Sánchez Rodríguez
[5]Crispim Calonji Maria Cabongo
[6]Mavudi Maleka

Polytechnic Higher School of Lunda Sul
ULAN
Saurimo, Angola

Abstract: The problem of the environment has become one of the main concerns of humanity in the present century. Human activity has put the existence of life in crisis and has compromised the creation of the foundations of a viable and sustainable world. That is why the danger of man's self-destruction is a bad one that constantly lurks if one does not have a clear awareness of the vulnerability of this small planet inhabiting the human species. The authors of this investigation carry out an analysis of the environmental effects on the soil of the city of Saurimo, in the province of Lunda Sul, Angola. The existence of ravines, their causes and the main processes that cause their origin and development are discussed. During the investigation they use a system of the same theoretical methods that empirical, especially the interview to residents of this territory and the observation directed to prove in practice these problems. As another of the most important results of this work, the possible measures to mitigate the affectations that provoke them are presented.

Keywords—*ravines; environmental; affectations; soil*

I. INTRODUCTION

Environment problem has become one of the main concerns of humanity in the present century. Human activity has put the existence of life in crisis and has compromised the creation of the foundations of a viable and sustainable world. That is why the danger of man's self-destruction is a bad one that constantly lurks if one does not have a clear awareness of the vulnerability of this small planet inhabiting the human species.

Environmental deterioration is present on a planetary scale and current and future human generations need to develop ways of thinking, feeling and acting with respect to environment, different from those that still prevail, so the whole population must be prepared to face these provocations, and above all, to be able to leave as inheritance to the next generations a planet where one can continue living and there is a balance between man, society and nature.

When talking about environmental deterioration it is necessary to refer to soils as an important component of the medium. The ground is a layer of variable thickness that covers the rocks exposed on the earth's surface. It is a living being that is in direct relation with the plant life and is constituted by mineral elements, crystalline or amorphous; organic, living beings, water and air. These materials underwent constant changes due to changes in the climate, the atmosphere and the action of man. It is, therefore, a dynamic complex, that evolves with time the speed and variable rhythms for each of the elements that form it and for its interactions.

As [2]. to [8] soil is the result of the interrelated action of different training factors, such as source material (mother rock), climate, topography, biological factor (ball, animals, man) and age. These factors, when interacting, give rise to the processes of formation and with this to the different types of soils, so it is the residue of the alteration, the removal and the organization of the upper layer of the terrestrial shell, under the action of life, the atmosphere and of the energy changes that are manifested there.

The deep economic and social transformations that occurred on the planet over the years had a direct impact on the use of this natural resource, deteriorating east in one way or another, in correspondence with an erosive process that in a systematic way the man provoked with their daily performance.

The following is the evidence of this serious environmental problem in the province of Lunda Sul, specifically inSaurimo city. The aim of the authors is to analyze in an evolutionary way the accelerated erosive process of the urban area ofSaurimo city, based on the assessment of origin and development of ravines in this city.

II. CHARACTERIZATION OF THE TERRITORY OF SAURIMO

In geographics terms Saurimo is located in northeast part of Lunda-Sul province, being the capital of this one, confined to the North with Lunda-Norte province, to the south with Moxico province, to the East with the RDC and in the West with Malange province. It is located 1050km from the country's capital, Luanda, Republic of Angola. With an area of 23,327 km2 and an estimated population of 200,820 inhabitants, it is subdivided into two (02) communes, with 104 villages, 116 villages and 16 districts (according to the Municipal Administration of Saurimo). It was known by Henrique de Carvalho during Portuguese Administration, and ascended the category of city on May 28, 1954.

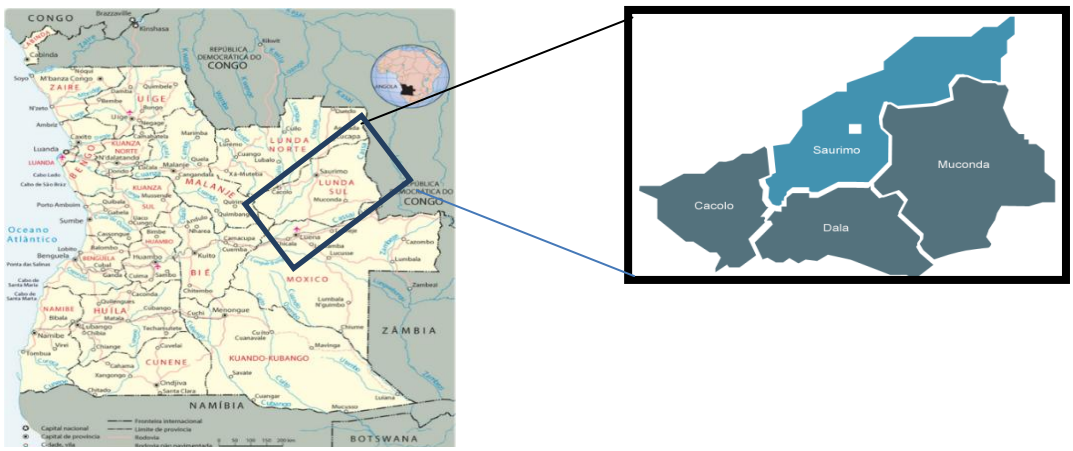

Fig 1: Geographic location of Lunda Sul province and Saurimo city.

The geological constitution of the region lies within the limits of the Mega shield structure of Cassai and the continental depression of the Congo, Saurimo is within Cassaiperiphery, which encompasses several metamorphic, sedimentary and volcanic rocks of the archaic, Proterozoic and Phanerozoic.

The deposits of rocks of continental origin represented by the Kalahari Group lie sub-horizontally through a gap, under the underlying sequences, weakly affected by tectonic disturbances. As Saurimo city is accentuated on the Kalahari group, so it is represented by a tall, yet of the clayey material and fine sands. The predominant types of soil in this region are sandy and clayey moderately deep and sandy clay of plastic mass containing 65.2% of clay 11% of saline substance and 28% of sand.

III. EROSION OF SOILS. RAVINE FORMATION PROCESS

At present the accelerated erosion of the soils can be considered in serious environmental problem. The removal of a source area from the debris of weathered rocks through the action of atmospheric agents (movable agents): from rainwater, wind, ice, glaciers, sea waves, is considered as erosion. pluck and separate the rock fragments.

The surface of the Earth is formed by both geological processes that form rocks, and by natural processes of degradation and erosion. Once the rock is broken because of degradation, the small pieces can be moved by water, ice, wind or gravity.

Erosion destroys the structures (sands, clays, oxides and humus) that make up the soil. These are transported to the lower parts of the reliefs and in general will sediment streams. It involves all soil and rock-wearing processes and is a very serious problem, so soil conservation practices should be adapted to minimize the problem.

In soil covered by vegetation, erosion is very small and almost non-existent, but it is a natural process that is always present and important for the formation of reliefs. The problem occurs when man destroys vegetation for agricultural use and leaves the soil exposed because erosion becomes severe and can lead to desertification.

Erosion can be classified in different ways for example: the rainfall erosion that is caused by the removal of the material from the surface of the soil by rainwater. This action is accelerated when the water encounters the soil unprotected from vegetation. The first action is through the impact of water droplets on the ground. It is capable of disintegrating the clods and aggregate of the soil, throwing the thinner material up and away, a phenomenon known as spattering.

The impact force also drives the finer material down the surface which causes soil porosity (sealing) to be obstructed, increasing surface flow and erosion. The action of pluvial erosion increases as more rainwater accumulates in the ground, that is, the soil withdrawal occurs from top to bottom.

Erosion destroys the structures (sands, clays, oxides and humus) that make up the soil. These are transported to the lower parts of the reliefs and in general will sediment streams. Landslides are more frequent in sandy or loamy soils with an easy slip, so it is possible to relate the formation of ravines directly with soil erosion, since they can be considered types of erosions that occur in soils.

Ravines are processes of erosion caused by the action of water on land devoid of vegetation cover. As a geological phenomenon it consists of the formation of large erosion holes caused by rains and bad weather in soils where vegetation is scarce and no longer protects the soil, which is exposed and susceptible to flood loading, poor, dry and chemically dead. Converting to a precipice or depression in the soil produced by a large amount of water flowing down a slope, caused by the physical weathering of the rainfall and are considered erosive actions. The sediments resulting from these climatic actions are shifted to the lower parts and deposited there. Coluvios and slope deposits are thus formed, characterizing the sedimentation process.

Once the formation of the ravine has begun, it evolves according to the relative consistency that presents the different horizons of the soil; when the consistency of the material is relatively uniform, the walls of the ravines are more or less vertical, whereas when there is an increase in the resistance of the lower layers, they develop in a "V" shape. [1] describes the growth of ravines as the result of different forms, which act either alone or in combination.

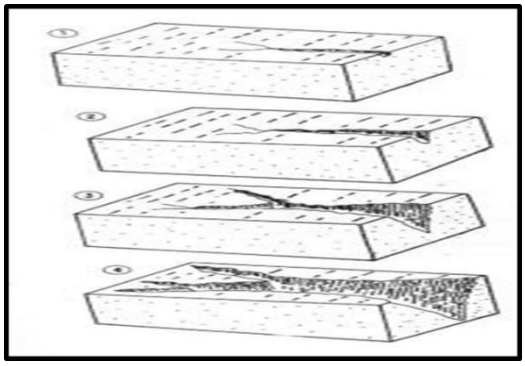

Fig 2: Ravines formation.

However, it does not mean that erosion is a problem, it only becomes when it changes the balance of nature, they occur from top to bottom. The nature of the eastern region of Angola is favorable for the appearance of ravines, due to soil characteristics, the terrain slope and the climate of this region.

Most problems of formation of ravines are caused by geological processes, morphodynamic, hydrological and anthropogenic processes. The processes that occur in it trigger abiotic, biotic, human and economic actions that are visualized in large impacts.

According to their origin they can be classified:

1- Natural Origin

The emergence of a ravine is associated with the process of linear erosion, that is, of the wild waters that occur on the surface with velocity from the points to the upstream points that lead to ravine.

Once the groundwater level has reached the beginning of the erosion process. In this erosion the groundwater rising to the bottom of the ravine's head starts to undermine its base, forming a tunnel, which leads to the collapse of its roof, progressing up the ravine upstream of the underground stream in a direction opposite to that of river erosion.

Fig 3: Ravines formation. (Ravines in Txizainga, Candembe e Santo Antonio neighborhoods).

2. Origin of Human Action.

This can occur in the following ways:

- Regulation of the sewage collectors that gave access to the rivers taking into account the system of urban sanitation and basic sanitation inadequate to the levels of international standard inherited from the colonial period;

- Practices of inadequate urban occupation and anarchic constructions without observing the norms of spatial planning (Master Plan).

- Deforestation and improper excavation of the soil.

-Lottages without flow due to surface water and server.

IV. CHARACTERIZATION OF EROSIVE PROCESS AND THE FORMATION OF RAVINES IN SAURIMO CITY

- Scrubbing at the bottom or sides of the ravine by current and abrasive materials (soil particles or trailing debris).

- Erosion by the water that precipitates in the head of the ravine and that causes the progressive regression of this.

- Lateral collapse of the ravine by the lubricating action of the infiltration waters.

This phenomenon presents itself in a significant way in areas of Saurimo city, showing an accelerated increase in the last decades. As an obvious example of this process can be mentioned the areas of the districts of Txizainga (Community Adolfo), Candembe, and Santo António, among others.

V. EVOLUTIONARY STUDY OF RAVINES OF FINA IN NZAGI NEIGHBORHOOD

The Community of Adolfo is located in north direction by the access road to Muconda municipality approximately 4 km from the center of Saurimo city, with the following geographic coordinates: 9º 38 '49. 12 "S - 20º25' 4.63" E.

In this area there are soils with an iron composition composed of goethite minerals and reddish-colored hematite generally visible in the lower part of the ravines and with the presence of the dark colored organic material visible in the upper part of the ravines.In terms of vegetation it almost does not exist because the population dismantled the zones for manufacture of adobo in the construction of residences.

There are ravines that occupy some streets making it difficult for the population to move. The beginning and formation of the ravine are of very little time, first decade of the 21st century. According to the ground reconnaissance done at the end of 2014, it can be verified that the ravines occupied approximately 25% of the area. The current length is approximately 1100m with a width of 5m and a dimension of 4-5m deep. There was a widening of more than 3m.

In relation to the previous years, it can be seen the growth of the same. With the frequent rains there was more collapse in the slopes of the ravine which originated its growth, and already there is a considerable growth of vegetation inside in the slopes of the ravine which prevents the collapse of the ravine.

Fig 4:Ravines in Adolfo neighborhood.

The population of this area is subject to a due threat the risks that occur when constructing their residences in the same vicinity.

VI. EVOLUTIONARY STUDY OF RAVINES IN CANDEMBE NEIGHBORHOOD

It is located north of the city of Saurimo (9º40'41.60 "S- 20º21'36.39" E). It has clayey soils of yellow and black coloration. The vegetation is almost non-existent.

It is a ravine 40-50m deep and 15m wide in the vicinity of the river Camuncudjo, with clayey soil with a yellowish color. It is the greatest of all and of great danger, because the residences are close to them. The inhabitants make excavations along the residences to manufacture marinades contributing to the growth of the ravines.In this area there were already landslides that caused the deaths of people, causing panic to society. As happened on January 28, 2010 that caused the death of five people.

Fig5:Ravines in Candembe neighborhood.

Another large ravine lies westward 9 km from the town- 5 years ago this ravine was 15m wide, currently due to large rainfall widened more than 5m.

VII. EVOLUTIONARY STUDY OF RAVINES INSAN ANTÓNIO NEIGHBORHOOD

It is located to the east of the city (9º40'18.21 "S-20º23'31.19" E) has sandy soils of dark reddish color with the same behavior in relation to previous cases.The entrance of the neighborhood existed a small erosion that was in the phase of development with a width of 2-3m and 1m of depth.

Fig 6: Ravines in San Antónioneighborhood, in their beginning.

With the implementation of the stagnation and monitoring program are being carried out by the provincial government, drainage ditches were built for the drainage of surface water as well as paved streets.

Fig7:Drainage ditches where ravines were located.

VIII. CONSEQUENCES OF THE FORMATION OF RAVINES IN THE DIFFERENT DISTRICTS OF THE CITY

- Destruction of roads; the place where there were roads is being occupied by ravines.
- Populations at risk, because their residences have a distance of 2-3 m from the ravine, this will cause them to disappear or collapse.
- Sedimentation of the Muangueji, Camahundjo and Luavur rivers, because the sediments are deposited directly in the river channel. This is affecting the Chicapa River.
- Pollution of river water causes the dragging of substances and residues to the bodies of water and, as a result, imbalance in the fauna and flora causing (eutrophication), and causes death in the bottom of rivers and lakes by burial.
- Populations at risk, because their residences have a distance of 2-3 m from the ravine, this will cause them to disappear or collapse.
- Sedimentation of the Muangueji, Camahundjo and Luavur rivers, because the sediments are deposited directly in the river channel. This is affecting the Chicapa River.
- Pollution of river water causes the dragging of substances and residues to the bodies of water and, as a result, imbalance in the fauna and flora causing (eutrophication), and causes death in the bottom of rivers and lakes by burial.
- Modification of relief, loss of fertile soil for agriculture.
- Disappearance of fauna and flora.
- Landslide, because of stability in the zone and change of locality due to the collapse of the residences.
- Trawls can cover up portions of fertile soil and bury them with arid materials.

Fig 8: Landslide inCandembe neighborhood.

Fig9: Sloping landslide with slopes of Txizainga neighborhood of the Adolfo Community.

IX. MAIN GEOLOGICAL RISKS RELATED TO THIS EROSION PROCESS IN THE CITY OF SAURIMO

- Landslide: The distance between the ravines and the residences is 3-4m being a risk for the inhabitants of the same, as well as for those who will wash their clothes and bathe in the water channels, which are at the bottom of the ravines (Candembeneighborhood).
- Mountain slopes (Adolfo Community and transition of the population to the Candembeneighborhood).
- Contamination of the water table causing effects on the natural environment. (Candembeneighborhood and Adolfo Community).
- Abundance of sediment causing the turbidity of river waters to become water improper for consumption (Muangueji River).

X. RECOMMENDATIONS TO MITIGATE THE EROSION PROCESS AND THE FORMATION OF RAVINES IN THE CITY OF SAURIMO.

- Inform the population of the danger they are exposed by the presence of ravines in these areas.
- Awareness of the population of the area with the need to avoid the causes that can cause the accelerated increase of this environmental problem
- Conduct a geological study of affected areas, with specialized teams for impact assessment and recovery.
- Suggest to the provincial government the construction of stone and cement fortified benches and the implementation of a river drainage system and maintenance of the same, at points of water falls with considerable speed to slow the energy of the same.
- Motivate the inhabitants to assume repopulation of the area with plants to help contain the erosion.

XI. CONCLUSIONS

The problem of formation of ravines is caused by geological processes, but the action of man can increase them and become serious environmental problems. In Saurimo city these phenomena are added, so there must be different joint actions to minimize this process, the risks they bring to the population of the territory and the consequences they can cause in the local environment.

ACKNOWLEDGMENT

Our thanks to the people of the neighborhoods of Saurimo city where we did this investigation, due to their collaboration in all the answers to the questions formulated.To the Polytechnic Higher School of Lunda Sulwhich helps the authors with the necessary means to carry out this research.To all of our colleagues and family members who supported us.

REFERENCES

[1] FAO, UNESCO, WMO 1977. Desertification Map ofthe World, United Nations Conference on Desertification.

[2] http. Wikipedia.org/ wiki/ Weathering.

[3] http://www.cnpab.embrapa.br/publicações/sistemadeprodução/voçoroca/ índex.

[4] http: // www.monografias.com. Monitoring of gullies in the city of Bolivar.www.suapesquesa.com/pesquisa/tipos-solos.The relationship between erosive agents and types of erosion.

[5] Páez, M. 1980. Contribution to the study of precipitation as an erosion factor in tropical conditions.Chaguaramas (Edo. Guárico). Master's Degree Tesis. Agronomy Faculty. Central University of Venezuela. Maracay: CUV.

[6] OGE plan. Provincial Board of Territory and Urbanism in Saurimo /2013

[7] Quarterly Report of Provincial Board of Civil Protection in Saurimo /2018

[8] Muginga, H.& Lopes, A.M. 2015. Evaluation of Ravines in Saurimo city.