

DIAGNOSES OF POTENTIAL EROSION AREAS AND LAND USE CONFLICTS IN THE ARAPUTANGA MUNICIPALITY, MATO GROSSO STATE (MT), BRAZIL

Camila Calazans da Silva LUZ¹

Cleber Aparecido de BARROS¹

Sandra Mara Alves da Silva NEVES²

Ronaldo José NEVES²

Maria Cândida Moitinho NUNES³

Abstract

The objective of this study was to diagnose the potential degradation areas due to water erosion and the conflicts derived from land use in the Araputanga municipality / Mato Grosso State. A geomorphologic and pedologic compartmentalization was generated from the superposition of soil and geomorphology maps; the erodibility by the association of the soils map of the erodibility information; the susceptibility to water erosion from the combination of the erodibility maps and the topographic factor. The vegetation cover and land use map were drawn from the Landsat 8 images of 2016. The current potential for water erosion was generated from the combination of maps on susceptibility to erosion with land cover/land use. For the assessment of conflicts, maps of current potential for water erosion and land use capacity were used. In Araputanga municipality, the Luvisols cover 62.93%. A high erodibility predominates in 73.09%; human activities occupy 64.98%. There is an average potential to water erosion in 86.31% and an average for land use conflict in 40.40%. The high erodibility due to the physical and chemical characteristics of the soil appears in gullies. It is necessary to readjust the land use in order to reduce the environmental problems and to maintain the landscape functions.

Key words: Geo-technologies. Erosive processes. GIS. Environmental degradation.

¹ Universidade do Estado do Mato Grosso UNEMAT/Campus of Tangará da Serra Masterís Graduate Program in Environment and Agriculture Production Systems Rod MT 358 km 07 Box 287 Jardim Aeroporto Tangará da Serra, Mato Grosso. CEP: 78300-000. E-mails: camila_agronomia@hotmail.com; cleberapbarros@hotmail.com

² Universidade do Estado de Mato Grosso-UNEMAT/Campus Cáceres. Associate professor of the Geography department. Laboratory of Geotechnology. Avenue. Santos Dumont, w/n. Santo Dumont. CEP: 78200-000 Cáceres/MT, Brasil. E-mail-s: ssneves@unemat.br; rjneves@unemat.com

³ Universidade Federal de Pelotas (UFPEL)- Faculdade de Agronomia Eliseu Maciel/FAEM. Professor of Agronomy Course Assistant. Campus w/n, CP 354, CEP: 96010-900, Pelotas/RS. E-mail: nunes.candida@gmail.com

Resumo

Diagnósticos de áreas potenciais à erosão e conflitos de uso da terra no município matogrossense de Araputanga, Brasil

O objetivo deste estudo foi diagnosticar as áreas potenciais à degradação por erosão hídrica e os conflitos derivados do uso da terra no município de Araputanga/MT. A compartimentação morfopedológica foi gerada da sobreposição dos mapas de solos e geomorfologia; a erodibilidade pela associação ao mapa de solos das informações de erodibilidade; a susceptibilidade à erosão hídrica da combinação dos mapas de erodibilidade com o de fator topográfico. O mapa de cobertura vegetal e uso da terra elaborado a partir das imagens do Landsat 8 de 2016. O potencial atual à erosão hídrica foi gerado a partir da combinação dos mapas de susceptibilidade à erosão com o de cobertura e uso da terra. Na avaliação dos conflitos foram utilizados os mapas de potencial atual à erosão hídrica e o de capacidade de uso da terra. Em Araputanga os Luvissoles recobrem 62,93%; Predomina em 73,09% a erodibilidade alta; As atividades antrópicas ocupam 64,98%; Ocorre em 86,31% médio potencial à erosão hídrica e 40,40% médio conflito de uso. A alta erodibilidade, decorrente das características físicas e químicas do solo, reflete em voçorocas, sendo necessária a readequação do uso das terras para que ocorra a redução dos problemas ambientais e a manutenção das funções dos componentes da paisagem.

Palavras-chave: Geotecnologias. Processos Erosivos. SIG. Degradação Ambiental.

INTRODUCTION

Agricultural development in Brazil is increasing fast, and one of its characteristics is the massive use of natural resources and the incipience of adequate planning, which together with the edaphic-climatic characteristics promotes soil erosion losses.

According to Oliveira et al. (2010, p.141), millions of tons from agricultural soil due to erosion are lost every year throughout Brazil. This situation persists, since losses continue to be high due to missing appropriate management techniques to the soil, causing environmental, financial and social damages.

The main human activities contributing to the acceleration of landscape degradation components (geomorphology, pedology, hydrography, etc.) are agriculture, mining, excavation and road opening (INBAR et al., 1998, p.29).

According to Mafra (1997, p.113), the study of erosion processes and detection of most susceptible areas should be done together with land planning, aiming to regulate human action on fragile sites, with minimum incidence of use to avoid damages to economic activities and the environment.

So it is necessary not only to indicate the environmental problems caused by society and the way to recover them, but also to analyze the degree of fragility from the different environments to the interferences, aiming to minimize the environmental risks. Planning is based on a holistic reading of the environment, considering the process of occupation, development and appropriation of the territory and its resources, always focusing on the conservation of its structure, fauna and flora (ROSS, 1990; LIMA; MARTINELLI, 2008, p.01).

In this sense, one of the most efficient ways to provide subsidies to the selection of priority areas from the point of view of soil conservation and recovery is the use of potential to laminar erosion maps, which can efficiently show the expectation of loss from soils under land occupation systems and the basic zoning with restricted areas for occupation (FROTA; NAPPO, 2012, p.1480; ARAGÃO et al., 2011, p.732).

The land incorporation process in the Araputanga municipality for the development of farming activities implied in changes of the natural dynamics and degradation of landscape components. Therefore, this study aims to diagnose potential degradation by water erosion and the conflicts derived from the land use in the Araputanga municipality using geo-technologies, to contribute with subsidies for the land use adequacy and municipal planning.

MATERIAL AND METHODS

Area under study

The Araputanga municipality, with an area of 1,600,240 km² (BRASIL, 2017), is part of the SW Mato Grosso Planning Region (MATO GROSSO, 2012) and it is 350 km from the capital, Cuiabá (Figure 1).

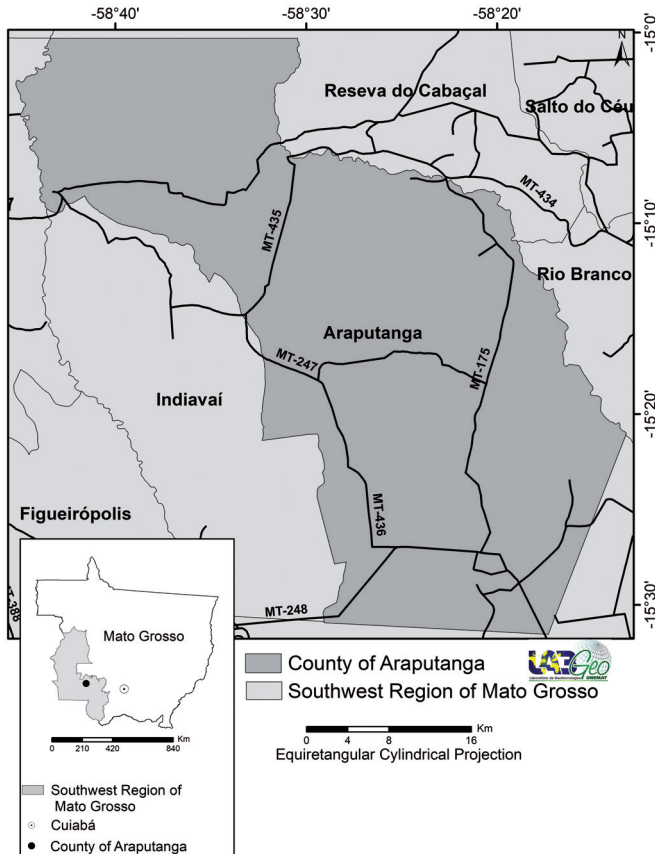


Figura 1 - Araputanga municipality in the regional and municipal contexts

Source: Labgeo UNEMAT, 2017.

It has a population of 15,342 inhabitants (BRASIL, 2017), from which 80.40% live in the urban area and 19.60% in the rural area. It has a Human Development Index (HDI) of 0.725, equal to the State average, which is 0.725 (UNDP, 2010). The climate in the region is the Moist Mega-thermal Tropical of the Lower Jauru-Rio Branco Plateaus and Depressions, with annual average temperatures above 25° C and rainfall totals between 1400 and 1600 mm. Its main characteristics are two, well defined as dry and rainy seasons. Water deficits become moderate to severe, from 200 to 250 mm, and there is also a decrease in water surpluses, ranging from 200 to 600 mm (TARIFA, 2011, p. 84).

Methodological procedures

The cartographic bases of Soils and Geomorphology maps were obtained, at scale 1: 250,000, at the State Secretary for Planning and General Coordination of Mato Grosso State - SEPLAN / MT. These were later compiled, matched and organized into the Geographic Database in ArcGIS, version 10.5 (ESRI, 2017).

For the Vegetation Cover and Land Use maps, Landsat 8 images from 2016, Orbit 228, Points 70 and 71 were acquired, with spatial resolution of 30 meters. The following procedures were performed: cutting, segmentation, supervised classification with Spring software from the National Institute for Space Research - INPE (CÂMARA et al., 1996) version 5.2.6 and post classification with ArcGIS. Clipping was made using the digital cartographic base of the municipality as a mask.

The segmentation was made using the region growth method; similarity thresholds were 100 and area 100. According to Nascimento et al. (1998, p.983), similarity refers to the maximum Euclidean distance between the spectral centers of two regions and the area is the minimum pixel size of a region to be delimited. Eight classes were defined in the classification made, based on literature research at the Project for Conservation and Sustainable Use of Brazilian Biological Diversity - PROBIO I (BRASIL, 2007a) and the Technical Manual for Vegetation and Land Use (IBGE, 2012). The classifier used for this procedure was Bhattacharya, with an acceptance threshold of 99.99%. The classification obtained was exported in Shape file format. The post-classification was carried out in ArcGIS, using the information obtained during field survey carried out in February and July 2016.

The geomorphologic and pedologic compartmentalization were performed with the association of Geomorphology and Soils maps in ArcGIS, (MATO GROSSO, 2007), using the Intersect tool.

The erodibility map was generated by the insertion in the Soils map, which nomenclature was updated according to Embrapa (2006, p.339), considering class information and indexes related to erodibility, suggested by Salomão (2010, p. 239) and Carvalho (2008, p.220).

The Topographic Factor Map (LS) corresponds to the map of iso-declivities from Salomão (2010) and was obtained from a Digital Elevation Model (DEM), generated from the interferometry radar (SRTM - Shuttle Radar Topography Mission), with spatial resolution of 30 x 30m, available free of charge from the United States Geological Survey (USGS). The digital processing of the scenes included: mosaic generation, verification of negative altitude values, as well as non-existent altitude values and projection conversion. After its reclassification and combination, a map of homogeneous ramps was generated. From this map, values of mean ramp slope and ramp height were obtained, according to the methodology proposed by Fornelos and Neves (2007, p. 186).

The relief was classified according to BRASIL (2007b, p.265) considering the following categories: Slope 0 to 3% - flat relief; from 3.1 to 8% - soft rolling relief; 8.1 to 20% - rolling relief; from 20.1 to 45% - strong rolling relief; 45.1 to 75% - mountainous relief; and > 75% - steep relief.

The preliminary map of susceptibility to laminar water erosion was generated from the combination of ArcGis with the Combine function, Erodibility map and Topographic factor (LS). The definitions of erosion susceptibility classes, based on the percentage of slope, followed IPT classification (1990, p.25): I) Extremely susceptible; II) Very susceptible; III) Moderately susceptible; IV) Little susceptible and V) Little to not Susceptible. After the reclassification, the final version from the Map on Susceptibility to Erosion was generated.

In order to obtain a map of the current potential for water erosion, the map of susceptibility to water erosion was made compatible with the current land use map. The classification of the current potential for erosion was done as proposed by Salomão (2010, p.243): Class I: high potential - current soil use incompatible with susceptibility to laminar water erosion; Class II: medium potential - current soil use incompatible with susceptibility to laminar water erosion, possibly controlled with adequate conservation practices and Class III: low potential - current soil use compatible with susceptibility to laminar water erosion.

For the evaluation of conflicts, the information derived from maps of current potential to water erosion and land use classification (LEPSCH, 1991, p.50) was analyzed. The classification of the conflict, as well as the relationship between susceptibility to water erosion and land use capacity were made using the methodology proposed by Hermuche et al. (2009, p.118), according to the table below:

Table 1 - Relation between susceptibility to linear erosion and land use capacity

Susceptibility to linear erosion (Salomão, 1999)	Land use capacity (Lepsch, 1991)
Class I – Extremely Susceptible	Class VII e VIII
Class II – Very Susceptible	Class VI
Class III – Moderately Susceptible	Class IV
Class IV – Susceptible	Class III
Class V – Non-susceptible	Classes I, II e V

The generated files were corrected by information obtained in the field and after that, making use of the ArcGIS version 10.5., the layouts and the quantifications which subsidized the analysis were elaborated

RESULTS AND DISCUSSION

Three categories of vegetation cover and land use were identified (Figures 2 and 3), with eight thematic classes, three of which referring to natural vegetation, four to human use and one to water bodies (Table 2).

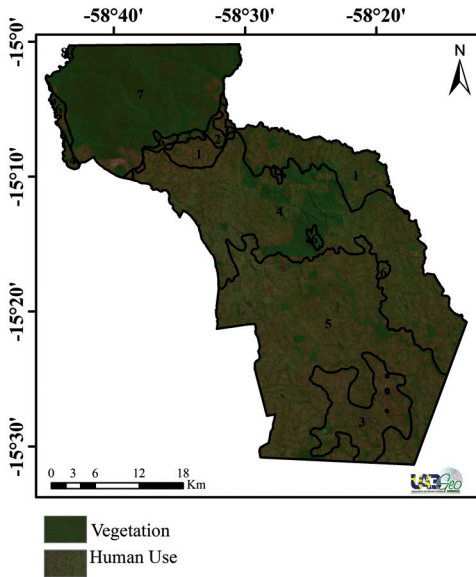


Figure 2 - Image Picture of the municipality of Araputanga / MT

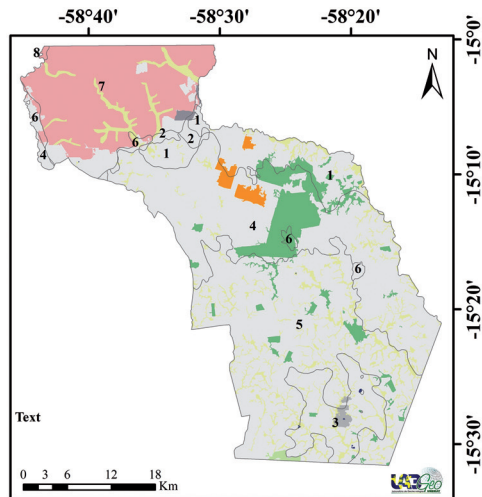


Figure 3 - Land use/land cover of geomorphologic-pedologic compartments in the Araputanga/ MT municipality

Table 2 - Description of vegetation cover and land use of Araputanga/MT municipality

Categories	Thematic classes	Area			
		ha	%	ha	%
Natural Vegetation	Seasonal Semi-deciduous sub-montane Forest	11531.55	7.21		
	Seasonal Semi-deciduous Alluvial Forest	12539.60	7.84	51854	32.410
	Savanna/ Seasonal Forest	1671.08	1.04		
	Forest Savanna + Park Savanna	26112.00	16.32		
Human Use	Livestock + Secondary Vegetation	49.04	0.03		
	Urban influence	597.10	0.37	108129	6.57
	Livestock	10748321.22	67.17		
Water bodies	Water	40.52	0.03	40.52	0.03
Total area				160024	100

Next, there are the characterizations of vegetation cover and land use according to BRASIL (2012, p.83).

The Semi-deciduous Alluvial Seasonal Forest is located in environments of sedimentary formations, characterized by the presence of large individuals, which stand out in their canopy, reaching 35 to 40 m. They occur in the depressions of water courses, at altitudes around 200 m, partially losing its leaves during the drought period. In the municipality, some fragments were mapped close to rivers and streams, since part of this vegetation was replaced for human use. The Sub-montane Semi-deciduous Forest occurs at altitudes varying between 300 and 450m, with variations of both structure and physiognomy, presenting, in some places exuberant structure with emergent canopy and height above 30m. In other sections they have fine structure, low size, uniform canopy. In Araputanga, it occurs at the highest altitudes, recorded in the central region of the municipality, corresponding to those areas with strong undulating, mountainous and steep relief, which according to the Forest Code (BRASIL, 2012, p.12) such natural vegetation must be preserved.

The Savanna areas occur in different climate types, but commonly in aluminized leached soils, presenting sinuses of small size hemi-cryptophytes, geophytes, oligotrophic phanerophytes. In the northern section of the municipality, these sinuses were found covering sandy soils with low agriculture aptness. This fact is probably contributing to avoid its suppression.

Livestock consists in a set of primary activities, directly associated to agriculture and animal breeding. Livestock, which occupies over 67% of the municipal area, is the main municipal and regional economic source. Thus, it is necessary to establish or enlarge conservationist practices in order to get sustainability and keep the natural components with the increase of productivity in those areas already in use, in parallel with the reduction of new pasture areas, favoring the conservation of remnants of the natural vegetation from the municipality.

The Urban Influence class corresponds to built-up areas for residential, commercial and industrial use. Water Bodies correspond to lakes and reservoirs, which occur in both urban and rural areas.

Eight compartments were identified in Araputanga city (Table 3 and Figure 4). Compartment 5 had a larger area, formed by Luvisols + System of Folded Bands (32.70%), followed by compartment 4, composed by Luvisols + Desiccation System in Hills and Hills (29.50%).

Table 3 - Description and representativeness of the geomorphologic-pedologic compartments in the Araputanga municipality

Comp.	Geomorphology-Pedology	Area (ha)	(%)
1	Red-Yellow Acrisols + Meander floodplain	13553.05	8.47
2	Red-Yellow Acrisols + Floodplain system	1510.05	0.95
3	Red Oxisol + Pediment system	11313.32	7.07
4	Luvisols + Dissection system in hills	47201.59	29.50
5	Luvisols + System of folded bands	52316.17	32.70
6	Luvisols + Systems of plateaus with horizontal strata	2327.46	1.45
7	Quartzarenic Arenosols + Meander floodplain	31640.44	19.78
8	Histosols + Meander floodplain	140.15	0.08
Total		1879.838.07	100

The Luvisols occur in 62.93% of the municipality area, corresponding to the most representative class (Figure 5). These soils vary from well to imperfectly drained, being usually shallow (60 to 120 cm), with horizons A, Bt and C, and distinct differentiation between horizons A and Bt, due to texture, color and / or structure contrast among them (EMBRAPA, 2006, p.24).

The Quartzarenic Arenosols, which occupy 19.77% of the municipality, are characterized by the absence of lithic contact in the first 50 cm depth, have a sequence of "AC" horizonsthat usually present aluminum toxicity. The sandy texture in all horizons can be constituted by 95% quartz, which conditions a low retention of moisture and of possible nutrient elements applied, being characterized as strong limitations to agricultural utilization (EMBRAPA, 2006, p.21; COELHO et al., 2002, p.111).

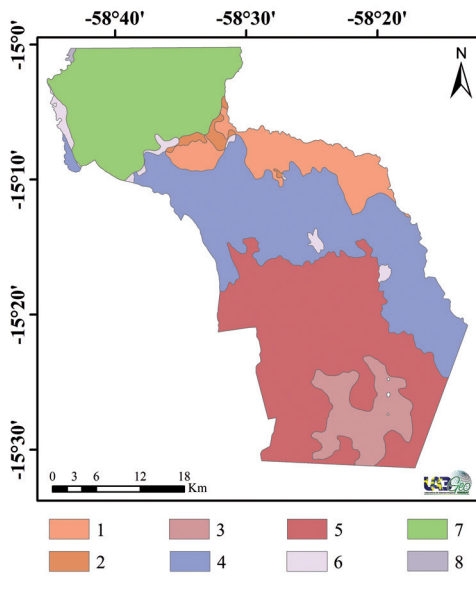


Figure 4 - Geomorphologic-Pedologic compartments of Araputanga/MT municipality

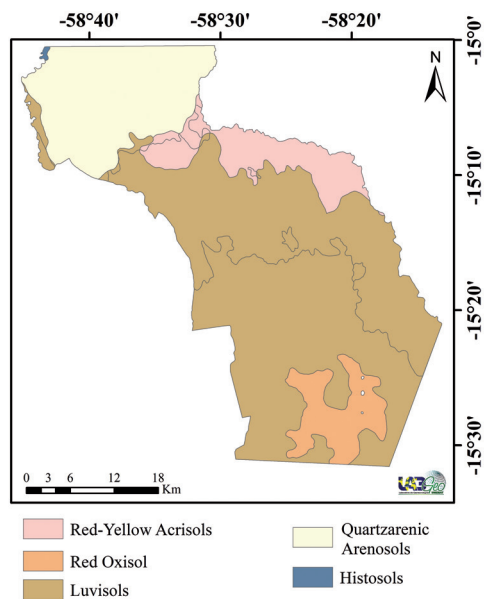


Figure 5 - Soils of Araputanga/MT municipality

The predominant relief class in the municipality is light undulated, occurring in 50% of the area, followed by plain relief with 28%, and undulated, with 19% (Figure 6). According to Silva et al. (1999, p.111), the use of light and undulated areas requires the adoption of simple soil conservation practices, such as: soil tillage and contour planting, use of permanent contour vegetation, crop rotation and Incorporation of cultural remains into the soil.

Regarding erodibility, the most expressive class was High erodibility, present in compartments 1,2,4,5, and 6 which correspond to 73.09% of the municipal area, with soils units Red-Yellow Acrisols and Luvisols (Figure 7). Acrisols are normally very erodible soils, mainly due to its intrinsic physical conditions, such as the texture gradient, i.e. the texture difference among surface and sub-surface horizons (BRASIL, 2007b, p.32). Luvisols present physical characteristics similar to Acrisols with some problems:

little depth and normally high amount of gravel, problems associated to low permeability on the top of horizon B, resulting in a high erodibility (LEPSCH, 2011, p.33).

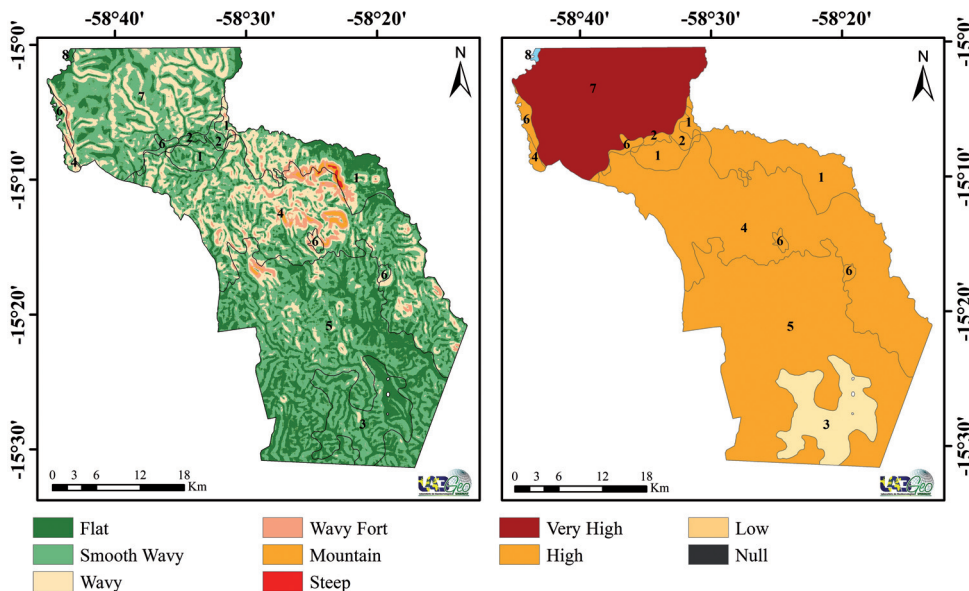


Figure 6 - Declivity in Araputanga/ MT municipality

Figure 7 - Soils erodibility classes in Araputanga/MT municipality

The second most expressive erodibility was very high, with 19.80%, occurring only in compartment 7, on Quartzarenic Arenosols. According to Neves et al. (2011, p.431) these soils are sandy and quartz rich, without weathered primary minerals, presenting low retention of nutrients and water. Due to the low adhesion and cohesion among particles, they have a high erodibility and are susceptible to high soil losses. This characteristic requires the adoption of conservationist practices, aiming to improve the soil structure and the reduction of degradation by erosion (VALLE JUNIOR et al., 2008, p.30).

The area with predominance of Red Oxisols, found in compartment 3, presented a low level of erodibility (7.07%), verified at Figure 5, justified by the junction of factors inherent to soil and relief, with declivity values below 3%. Considering that these soils are deep, well drained, with low exchange capacity, medium to fine texture (clayey to very clayey), they present good aggregate stability. Therefore, these soils are more stable and indicative of a higher structural quality (EMBRAPA, 2006, p.265; DE SOUZA et al., 2015, p.10).

Compartment 8, represented by Histosols in the floodplain region, was classified as with nil erodibility, corresponding to 0.08% of the municipal area.

The largest part of the municipal area is classified as very susceptible to water erosion (73.16%) as a consequence of high erodibility soils and of their use for livestock activity (Figure 8).

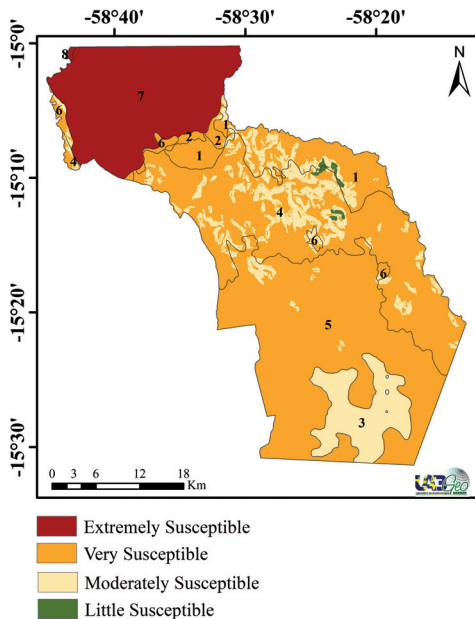


Figure 8 - Susceptibility to water erosion of geomorphologic-pedologic compartments in Araputanga/MT municipality

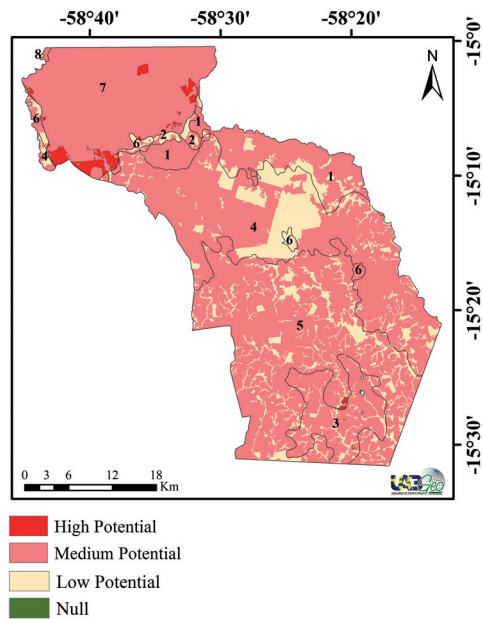


Figure 9 - Potential to water sheet erosion of geomorphologic-pedologic compartments in Araputanga/MT municipality

However, the geomorphologic compartment 7 was the only one classified as extremely susceptible to water erosion (Figure 8), possibly due to the soil type (Quartzarenic Arenosols), of high erodibility and to the light rolling to rolling relief. According to COGO (2003, p.479), the relief is a factor which strongly influences soil losses due to water erosion because with the increase of declivity there is an increase of the transport capacity of particles, reducing the water infiltration in the soil. Besides reducing its production capacity for cultures, erosion can cause considerable environmental damage, such as silting and pollution of the water sources. In spite of that, using adequate soil management systems and conservationist practices as support, the erosion problems can be satisfactorily solved.

Regarding the potential of water erosion, which indicates the intensity of human activities in areas susceptible to erosion, it was found out that 82.90% of the municipal area presents a medium potential, partially occurring in all compartments (Figure 9). This is justified by the present land use which is incompatible with the susceptibility to sheet erosion. However, it was observed that from this percentage, 22.09% refers to compartment 7, is composed by Quartzarenic Arenosols, which are highly susceptible to erosion, but it is in equilibrium because it is covered by natural vegetation. Therefore, it is recommended to keep the vegetation to protect the soil and the water springs, considering that there are several sources in this area. It is emphasized that the major problems regarding erosion in Quartzarenic Arenosols occur when these soils are unprotected by a vegetation cover, aggravating the shortage situation of aggregating materials (clay and organic material), which would increase the sediment load resulting from these processes in the water bodies and causing silting (PASSOS, 2010, p.29).

The other areas with Acrisols, Oxisols and Luvisols need an adequate management with conservationist practices to establish the resilience of agro-livestock activities in consonance with environmental conservation.

It was verified that 1.54% of the area from the municipality, corresponds to the class of High potential erosion, which means that the current use of the soil is incompatible with its susceptibility to laminar erosion. This occurs in areas of compartment 7, where soils are fragile and natural cover has been withdrawn due to the expansion of livestock farming in the region, which can lead to environmental damage due to improper use. According to Pruski et al. (2006, p.165), when the occupation is carried out without observing the limits and risks of environmental degradation, it can cause the development of accelerated erosive processes, being one of the main factors causing degradation and deterioration of environmental quality.

From this municipal area, 15.52% is classified as with low erosion potential, and the current soil use is compatible with its susceptibility to laminar erosion. These sections are covered by natural vegetation (Alluvial Forest, Savanna and Semi Deciduous Seasonal Forest).

Those areas classified as nil potential to erosion (0.02%) correspond to the places occupied by water (rivers, streams and lagoons).

From the total Araputanga land area, 58.37% presented a medium conflict of use due to the predominance of Luvisols and Acrisols in areas of flat to light rolling relief, originally occupied by low vegetation (Figure 10). According to Morgan (1996, p.08), the reduction of vegetation cover can increase the erosion by surface flow. This is because there will be more rain reaching the soil surface and less being intercepted by vegetation, which will entail the soil crumbling and reduce water infiltration. These areas are partially favorable to grazing and are more suitable for reforestation. In view of this, it is necessary to adopt preventive measures to avoid the degradation of the natural environments, as well as the appropriate land management according to its capacity of use.

Approximately 40.06% of the municipality presents a low conflict of use due to the presence of Oxisols and Histosols in flat relief and the presence of natural vegetation, being able to be cultivated only occasionally, since these areas are indicated for pastures and perennial crops. According to Ebeling et al., (2013, p.769) Histosols as well as Oxisols, are intensively used for family agriculture and are of great environmental importance due to its constitution, being formed by depositions of vegetal residues in different stages of decomposition resulting in high levels of organic matter and high natural fertility, which increases the agricultural potential of these soils (SILVA et al., 1999, p.114).

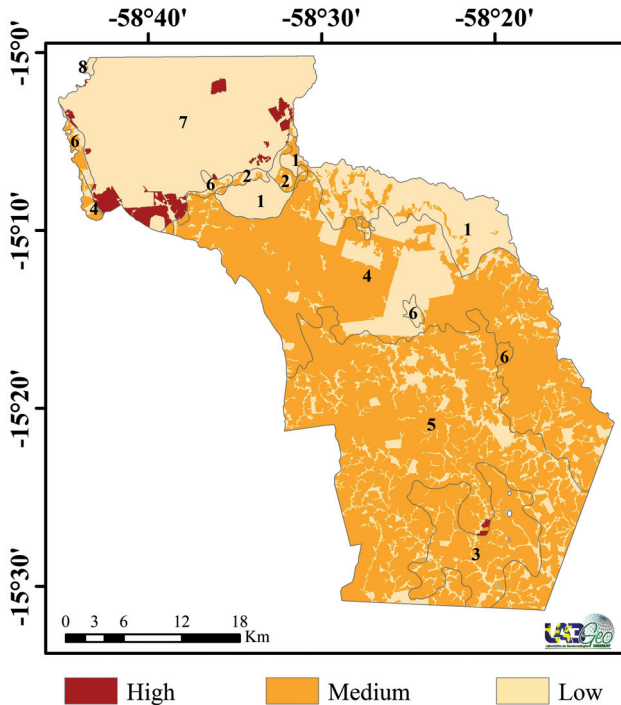


Figure 10 - Conflict of land use in the municipality of Araputanga / MT

In 1.53% of Araputanga's municipal area, the current land use is incompatible with the land use capacity, implying a high conflict. In these places the relief is light hilly to hilly and Arenosols predominate, which are considered fragile because of its sandy texture, conditioning low values of organic matter and CEC, as well as a high infiltration speed, making them highly erodible. Contrasting the effect of texture the position of these soils in the landscape, in flat to low relief, with slope below 3%, make them less vulnerable to erosion (VALE JÚNIOR et al., 2008, p.75).

These results highlight the need to use intense conservation practices to prevent degradation processes. Custódio Filho (2011, p.76) proposes some measures for the stabilization of the erosive process in agricultural areas, namely: isolation of the affected area with fence, avoiding cattle access, avoidance of traffic from machines which form tracks and hinder the growth of vegetation, for example.

Table 4 - Characterization of geomorphologic-pedologic compartments and classification of land use conflicts in the municipality of Araputanga – MT

Compartmento	Vegetation cover and actual land use	Relief	¹ Suscep..	² Pot.	³ Cap.	⁴ Con.
1. Acrissol Red-Yellow + Meander Floodplain	Agro-Livestock + Secondary Vegetation; Livestock + Secondary Vegetation; Savanna/Seasonal Forest Savanna; + Park Savanna + Forest Savanna; Alluvial Semi-deciduous Seasonal Forest; Sub-montane Semi-deciduous Seasonal Forest + Secondary Vegetation.	Light Rolling to Rolling	Very Susceptible	Medium	VI	Medium
2. Acrissol Red-Yellow + Floodplain System	Agro-Livestock + Secondary Vegetation; Savanna arborizada + Savana Parque + Forest Savanna; Alluvial Semi-deciduous Seasonal Forest, Sub-montane Semi-deciduous Seasonal Forest + Secondary Forest; Livestock + Secondary Forest.	Light Rolling to Rolling	Very Susceptible	Low to Medium	VI	Medium
3. Oxisol Red + Pediment System	Agro-Livestock + Secondary Vegetation; Alluvial Semi-deciduous Seasonal Forest; Sub-montane Semi-deciduous Seasonal Forest + Secondary Vegetation; Livestock + Secondary Vegetation; Water mass; Urban Influence.	Flat to Light Rolling	Moderately to Little Susceptible	Medium	IV	Low
4. Luvisols + Dissection system in hills	Agro-Livestock + Secondary Forest; Savanna/ Seasonal Forest; Savanna Forest + Park Savanna + Savanna Forest; Alluvial Semi-deciduous Seasonal Forest; Sub-montane Semi-deciduous Seasonal Forest + Secondary Vegetation; Livestock + Secondary Vegetation.	Light Rolling to Rolling	Very Susceptible	Low to Medium	VI	Medium
5. Luvisols + System of folded bands	Agro-Livestock + Secondary Vegetation; Sub-montane Semi-deciduous Seasonal Forest + Secondary Forest; Livestock + Secondary Forest; Water mass; Urban influence; Alluvial Semi-deciduous Seasonal Forest; Livestock + Secondary Vegetation.	Flat to Light Rolling	Moderately Susceptible.	Medium	IV	Low
6. Luvisols + Systems of plateaus with horizontal strata	Agro-Livestock + Secondary Vegetation; Forest Savanna + Park Savanna + Forest Savanna; Alluvial Semi-Deciduous Seasonal Forest; Livestock + Secondary Vegetation; Urban Influence; Sub-montane Semi-deciduous Seasonal Forest + Secondary Vegetation.	Light Rolling to Rolling	Moderately to little susceptible	Low to Medium	IV	Medium
7. Arenosols + Meander floodplain	Agro-Livestock + Secondary Vegetation; Forest Savanna + Park Savanna + Forest Savanna; Alluvial Semi-deciduous Seasonal Forest; Livestock + Secondary Vegetation; Water mass; Livestock + Secondary Vegetation	Light Rolling to Rolling	Extremely Susceptible	High and Medium	VII e VIII	High
8. Histosols+ Meander floodplain	Forest Savanna + Park Savanna + Forest Savanna	Flat to Light Rolling	Extremely Susceptible	Medium	VII e VIII	Low

¹ Susceptibility to water erosion; ² Potential to sheet water erosion; ³ Capacity of land use; ⁴ Land use conflict.

The economy from the municipality under study is based on agriculture, evidenced by an increase of 93% in the number of heads between 2008 and 2012, and 1,650 ha occupied by soybean and corn (MATO GROSSO, 2012, p.194). The intensive use of several areas from the municipality without observing the respective limitations of those areas classified as extremely susceptible to erosion that were presented in this study, may compromise their productive capacity.

The maps presented in this research reflect the conditions related to the time at which land use and occupation data were obtained. They should be periodically updated to reflect the real risks of erosive processes, which are dynamic because they are subjected to climatic conditions and human action.

CONCLUSIONS

The natural components of the landscape were explored without observing its limitations, which was evidenced by the results of the susceptibility to water erosion, the potential for laminar water erosion and land use capacity.

The soils in the Araputanga municipality present a high erodibility and are very susceptible to water erosion, due to their physical and chemical characteristics.

The agricultural activities in the municipality are growing, so it is recommended that soil conservation plans are defined in order to minimize the impacts of land use on the natural components of the landscape, such as soil and water.

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