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GEOPROCESSING APPLIED IN THE HYDROLOGICAL CARACTERIZACION AND ENVIRONMENTAL OF STREM DUAS AGUAS WATERSHGED - BOTUCATU (SP)

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ABSTRACT

That work aimed at the geoprocessing application in the hidrologic analysis and environmental of the Stream Duas Aguas watershed - Botucatu (SP) through the Geographical Information System - Selva, seeking to the preservation, rationalization of his use and environmental recovery. The watershed presents an area of 4007.19ha and it is located among the parallel ones 22º 43' 49" to 22º 49' 29" of latitude S and 48º 17' 53" to 48º 22' 03" of longitude W Gr. The results showed that the low value of the drainage density, they facilitate the infiltration of the water in the soil, reducing the superficial drainage and the erosion risk and of the environmental degradation, as well as the low value of the form factor (0.58) aided by the circular index (0.52) it indicates that the watershed tends to be more prolonged with smaller susceptible to the occurrence of inundations more accentuated, and consequently a tendency of smaller risk of the silting of the courses of water and of the environmental degradation of the drainage net.

Keywords: geoprocessing,drainage net, GIS-IDRISI.

1. INTRODUCTION

The region of Botucatu has been suffering with passing of the years predatory explorations and bad use of the soil that become worse, due to the inadequate methods and without planning of the occupation of the soil, carting with that the siltings of the rivers and of the reservoirs.

The inadequate use and without planning of the soil it turns it infertile in an irreversible way, provoking the low productivity of the cultures, tends as consequence the low level technological economical partner of the rural population.

Moraes et al. (1997) recommends that the recovery and preservation of the renewable natural resources (I sole, water and fauna), they should be accomplished in an integrated way, seeking to guarantee his maintainable use and his conservation for the future generations.

The research aimed at to accomplish the applied geoprocessing in the morfometricstudy of the Stream Duas Águas watershed - Botucatu (SP) through GIS Idrisi - Selva.

2. MATERIAL AND METHODS

The Stream Duas Águas watershed, Botucatu, SP, presenting 4007.19ha of area. It is located among the geographical coordinates: 22° 04' 49" to 22° 49' 29" of latitude S and 48° 17' 53" to 48° 22' 03" of longitude W Gr.

The analysis of dimensional variables of the Stream Duas Aguas watershed was realized through the software ArcGis 9.3 were: Area (A): line of the water divisor that delimits the watershed (Horton, 1945); Perimeter (P): line of the divisor topographical that it circumcise the watershed (Smith, 1950) and Net Total Length (Cr): length of the group of all of the rivers segments that they form the drainage net of the watershed (Horton,1945).

The composition of the drainage net that refers to the number and length of rivers in the different orders of ramification of a watershed (Horton, 1945).

The evaluation of the morfometric of the fluvial nets the following parameters were used: Rivers Number of Segments (N): number of rivers segments in each order and the total number of segments of rivers of the watershed of agreement with Horton (1945); Total Length of Segments of Rivers in each Order (Ctw): it represents the total length of the segments of rivers in each order (França,1968); Medium Length of Rivers in each Order (Cmw): it is the relationship between the total length of segments of rivers and number of segments of certain rivers for each order (França, 1968); Reason of Ramification or Bifurcation (Rb): expresses the relationship immediately between the number of segments of rivers of a certain order and the number of segments of the superiororder, Horton (1945) and Strahler (1957); Reason of Total Lengths (Rlw): it is immediately the relationship between the sum of the lengths of segments of rivers of a given order and sum of the segments of the order superior (Strahler, 1957); Reason of Medium Lengths (Rlm): it is immediately the relationship between the medium length of segments of rivers of a given order and the medium length of the segments of the order inferior, in agreement with Horton (1945) and the Relationship between the Reason of Medium Lengths and the Reason of Ramification (Rlb): relationship among the medium reason of lengths (Rlm) and the ramification reason (Rb), Strahler (1958), being calculated by the expression: Rlb = Rlm/Rb.

The variables of the relief pattern studied were the steepness of the ground determines the drainage of the waters of the rains, because as larger the slope, larger the drainage of the water for the surface and, consequently, larger the erosion risks (Mota, 1981). Being like this, it is a fundamental parameter to study the picks of inundations and the infiltration of water in the soil.

The medium steepness (H) it was calculated by the expression H = 100 D.L/A, where: H = Medium Total Length of the watershed in%, D = vertical equidistance of the level curves in km, L = total length of the curves of level of the watershed in km and total A= Area of the watershed in km^2 (Horton, 1914).

The medium altitude of the watershed (Hm) it was obtained through the arithmetic average among the values of larger altitude (AM) and the smallest altitude (Am) and the width altimetric (H) it is the difference between the largest and the smallest altitude of the watershed (Strahler, 1957).

The form coefficient (Cf) it was certain for the relationship among the area the geometric figure area and the watershed, as he Reads & Sales, mentioned by Souza (1977).

The roughness coefficient (RF) it was calculated through the formula: RF=Dd.D, where Dd is the drainage density and D the medium steepness in percentage (Rocha, 1999); the Relief Reason (Rr): it is the relationship between the width altimetric and the largest length of the watershed (Schumm,1956); the Reason of Relative Relief (Rrl): it is the relationship between the width altimetric and the perimeter of the watershed; Roughness Index (HD): it is obtained by the product of the expression width altimetric (H) x drainage density (Dd) (Strahler, 1958) and the circular index is determined by the relationship among the area of the basin (A) and the area of the perimeter circle same to the of the basin (Ac).

The Drainage Density (Dd) it is one of the relative variables to the characteristic of the drainage pattern used in the analysis of the net of drainage of a watershed. This is a fundamental physical parameter in the comparative analysis of the susceptibility among watersheds, according to Christofoletti (1974), because it relates the total length of the net drainage of the watershed (Cr) in function of the area (A).

3. RESULT AND DISCUSSION

The morfometric of the Stream Duas Aguas watershed, classified as of 3ª ramification order, according to the system of Strahler (1957), that it modified the system of rivers

classification (Horton, 1945), it is reflex of the conditions of the physical middle in that they are listed com the litologia, the geological structure and the superficial material (Silva, 2003).

The analysis of the dimensional variables (Figure 1, Figure 2 and Table 1) it allowed to verify that the area of the Stream Duas Aguas watershed was of 40.0719km². This variable is one of the most important, because almost all the other characteristics are related to her (Moreira & Rodrigues, 2010) and because this increases exponentially with the increase of the order of ramification of the rivers (Schumm, 1956) and they vary in accordance with the relationship infiltration/escurrimiento.

The dimensional variables are studied for many Brazilian researchers, because they allow the differentiation of the units of soils, as well as they are to contain watersheds of a same soil unit(Amaral, 1991).

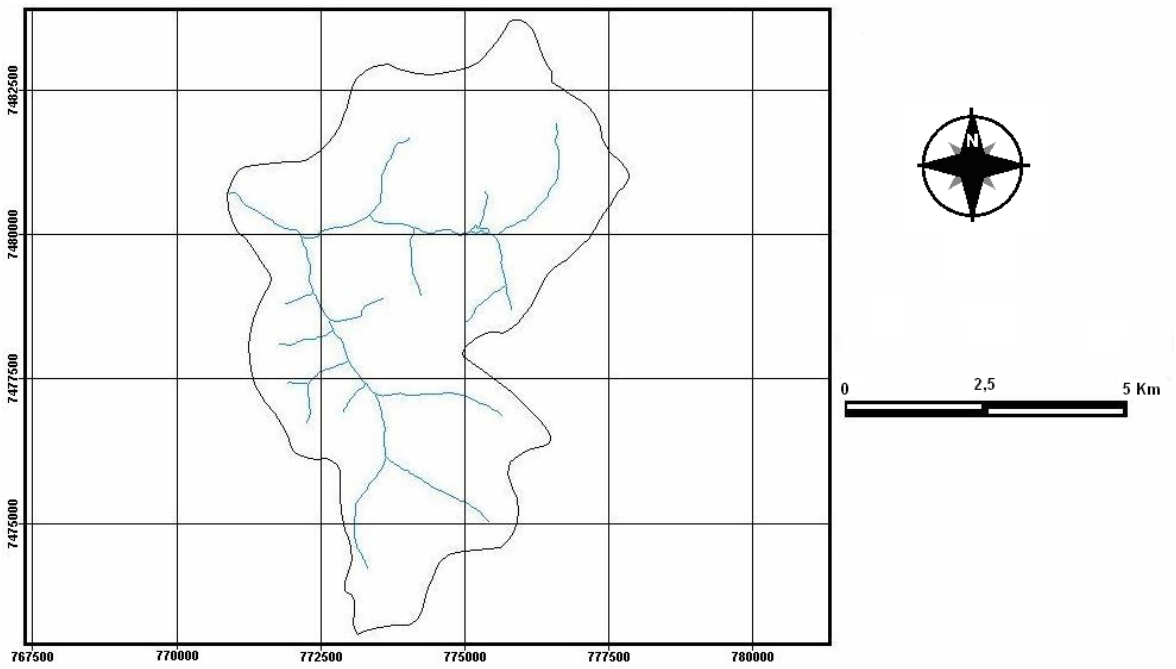

Figure 1. Hydrology of the Stream Duas Aguas watershed, Botucatu-SP.

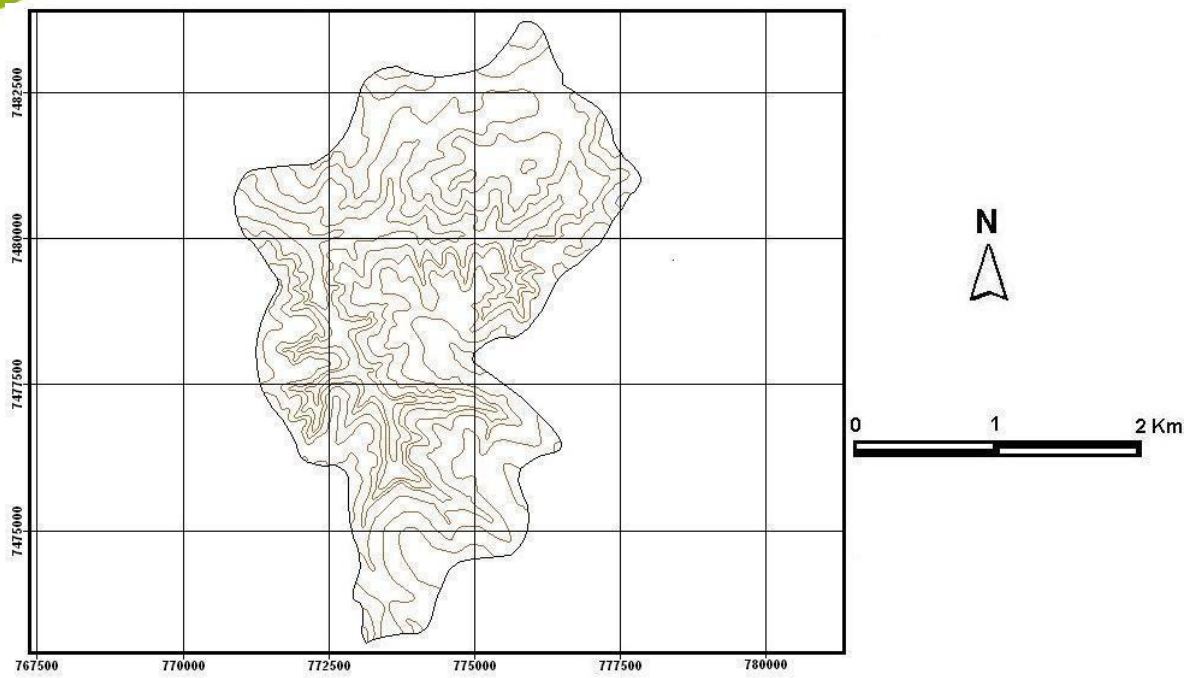

Figure2. Planiltimtric of the Stream Duas Aguas watershed, Botucatu-SP.

Table 1. Physical characteristics of the Stream Duas Aguas watershed, Botucatu-SP.

Characteristics physical	**Units**	**Resulted**
Dimensional parameters of the watershed		
Area (A)	Km^2	40.0719
Perimeter (P)	Km	31.12
Length (C)	Km	11.15
Drainage Length (Cr)	Km	51.97
Level Curve Length (Cn)	Km	206.28
Characteristics of the relief		
Compactness Coefficient(Kc)	---	1.38
Form Factor (Ff)	---	0.58
Circularidade index (Ic)	---	0.52
Medium steepness (D)	%	10.29
Medium altitude (Hm)	M	559.00

Larger altitude (MA)	M	620.00
Smaller altitude (mA)	M	480.00
Width altimetric(H)	M	140.00
Roughness Coefficient of (Rb)	---	13.37
Relief Reason (Rr)	---	0.013
Relative Relief Reason (Rrl)		0.045
Patterns of drainage of the watershed		
Watershed Order (W)	---	3ª
Drainage Density(Dd)	(km/km2)	1.29
Maintenance Coefficient(Cm)	(m/m²)	775.119
ExtensionSuperficial Course (Eps)	M	390.00

The watershed, usually come in the pear format, but they can present other forms that it depends on the interaction climate, geology among others. The surface of the watershed is always concave, which determines the direction of the water flow (Lima, 1986).

The drainage density (Christofoletti, 1974) it is a fundamental physical parameter in the comparative analysis of the susceptibility among watersheds, because it relates the total length of the drainage net (CR) and the area (A), and as adult is the value of the length of the drainage net (Cr) adult will be the erosion danger. The drainage density of 1.29km/km^2 for the Stream Duas Aguas watershed was classified as drop (France, 1968), that classifies as low when the smaller values than 2.5, the one that allows infer that the substratum has high permeable with larger infiltration and smaller superficial drainage of the water. For Ray (1963), the drainage density in a climatic ambient die this related mainly with the resistance to the erosion of the present materials, increasing as it reduces the resistance to the erosion. In that sense, the forests are fundamental in the control of the erosion and of inundations and, when located in places preserved appropriately are fundamental in the recharge of the water sheet.

The rivers length (Cr) allowed to verify that the watershed presents a drainage net of approximately 51.97km, denoted through their total lengths of 1ª and 2ª and total.

The value of 0.58 for the form index of the watershed is considered low, indicating that it presents larger susceptibility to the degradation, because the more close of 1 it is the form

factor, closer of the circular format it will be the watershed and, consequently minor will be the time of concentration (Tc) of the waters of the rains, because the torrents provoke floods, that possibly will cause erosions of the soil and degradation of the area riparium.

The coefficient of compactness of 1.38 and the circular index of 0.52 display that the more close of 1, more it will be close of the circular format and as adult goes this value, adult will be the danger of inundations. Like this, this value denotes that it doesn't have format to circulate, possessing in this case, a prolonged form and little susceptible to inundations in normal conditions of precipitation. That is proven for the circular index, indicating that it is smaller than 1, in other words, therefore the more close of 1, more he approaches the circular format.

4. CONCLUSIONS

The results of the morfometric of the Stream Duas Aguas watershed allowed to conclude that the variables morfometrics will be for futures plannings and regional environmental administrations. The watershed presents high susceptibility risks to the erosion and environmental degradation, being fundamental the maintenance of the vegetable covering and the areas riparium for conservation services environmental. The form factor and the drainage density, classified as bass, they allow to infer that the substratum has high permeable with larger infiltration and smaller drainage of the water. The Geographical Information System ArcGis 9.3 was excellent for the vetorizacion and data analysis.

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