EVALUATION OF THE ARBOREAL VEGETATION INFLUENCE AT THE ENVIRONMENTAL SUSTAINABILITY IN THE UNIVERSITY OF PASSO FUNDO CAMPUS, BRAZIL

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Abstract: One important aspect at the sustainable urban planning is the reserve of green spaces into various scales, due to the fact that they possess multiple purposes, reducing the pollution and contributing to the physical, social and psychological health of the users and the community that frequent those spaces. The replacement of the green areas for impermeable areas contributes, between other effects, for the floods and the heat of the urban surface, generating the heat island effect. The objective of this paper was to quantify the spatial distribution of the arboreal vegetation on the campus of the University of Passo Fundo, through geoprocessing techniques, correlating with the arboreal specimens existing, on the intention of comprehend its relation with the environmental sustainability and implications to the users of the campus. To quantify the spatial distribution of the arboreal vegetation were obtained images of high resolution from satellite, for the quantification was utilized the group of softwares ArcGIS 10.2, through the supervised classification technique, which classifies the original image into classes based on a number of samples. The area was classified inside of four distinct classes, arboreal formation, undergrowth, buildings/roads and water resources. Besides that, were evaluated the arboreal species present on the campus through the forest inventory. Were found over 102 different arboreal species with about 4100 specimens, being distributed in the whole area of the campus, this way favoring the benefits they bring, influencing on the microclimate and raising the air humidity through the evapotranspiration, providing an more favorable environment to the users, and allowing that the waters resulting from the precipitation infiltrate in the soil mitigating the rapid runoff, which is one of the factors that aggravate the formation of floods and spates. The vegetations are one important piece for the people that live and use the artificial ambient, avoiding the decline on the urban life quality and contributing at the sustainability. Because of that, there is the need to plan those artificial ambient, creating alternatives from the vegetations so that the users of these environments do not suffer the consequences of the lack of planning.

1 INTRODUCTION

The planning, the implantation and the conservation of green areas constitute a valuable well to the community, becoming an essential element to the cities and the universitary campus composition. With the fast populational growth, there is the need to expand the urban infrastructure, being intensified even more with the degraded situation that the environment encounter and changes even faster the natural environments, leading the removal of vegetation cover and the raise of the soil waterproofing, becoming harder to be restored through the time.

The sustainable development, designed by the ONU commission and the environmental questions starts to be understood as one need and not one barrier to the development, the environmental preservation

became an impulsing to the development (CMMAD, 1998). So, one of the engineering problems is related to the lack of knowledge from the professionals about the effects of their actions over the environment that they belong. Receiving a set of disciplines that forms the specific knowledge, but not the learning, it's necessary develop integrated attitudes and abilities with the theory and the practice, aiming the continuity of the knowledge through different phases of the progress. This way the qualification into different areas must evolve according to the needs from the market and the environmental sustainable questions.

In this context the quality of urban life is directly linked to several factors that are gathered in infrastructure in the economic and social development and to those related to environmental issues. In the case of environment, the green areas constitute essential elements for the well-being of the population, because it directly influences the physical and mental health of people and improving climatic conditions, especially with regard to the air temperature reduction by shading surfaces (Rossetti, 2005; MacGregor-Fors et al, 2011.).

The vegetation composition creates green paths or green infrastructure being an ecological tool for the environmental health, social and economic, with the potential to improve ecosystems and urban sustainability, featuring spaces for their colors and shapes, contributing in the climate control and environment pollution, water conservation, reducing erosion, environmental comfort, cultural values, recreational and promoting the biodiversity (Benedict & McMahon, 2006;. MacGregor-Fors et al, 2011). The replacements of these areas by paved areas also contribute to the floods and the heating of urban areas, generating the heat island effect.

The performance of the vegetation as thermal softening is proportional to the size of the vegetation and air flow in the arborized environment, acting as a thermoregulatory microclimate, due to their physical and morphological characteristics (Benedict & McMahon, 2006; Grimm et al., 2008).

Although urban trees had been widely known as decorative in the past, they have taken on new values and functions in modern cities (Sanesi & Chiarello 2006). Because the green areas are elements capable of reinforce stability and familiarity, and convey the idea of cleaner and healthier environments (Henwood & Pidgeon, 2001).

According to Rosset (2005), green areas are places where the arboreal vegetation is predominant, e.g. the squares, public gardens and urban parks, among other kinds of areas that provide aesthetical and ecological functions. The planning, implantation and conservation of green areas constitute an asset of great value to the community, becoming an important element in the urban composition and planning.

To realize the planning of green areas its indispensable the use of technics that allow the georreferencing and analysis tools, over different phases of the work, of specialized territorially information. In this sense, the application of Geographic Information Systems's technics has become a powerful tool that, when used along with other mapping softwares, allows not only a greater precision of the assessment, but also the ease of maintaining the database updated, leading to an most efficient way to monitor these areas (SILVA e ZAIDAN, 2004).

Besides, the geoprocessing allows that each area can be individualized through its features or digital signatures, so they can be better analyzed, expliciting the acting phenomena of each sector, reducing data interferences and thus obtaining more accurate results (VEIGA e SILVA, 2004).

The utilization of remote sensing applied to the study of the urban environment and mostly to the vegetation areas has advanced significantly with the use of high resolution satellite images, which allows a more detailed analysis of this environment (ARAUJO et al, 2011).

Henke-Oliveira & Santos (2000), emphasize the importance of the development of computational technics that contemplates the structural and functional differentiation of the green areas, what confers a dynamism to the environmental planning by allowing the information assessment to the management of these areas as well as other elements associated to the environmental and life quality, promoting this way the urban infrastructure sustainability.

The objective of this paper was to quantify the special distribution of the arboreal vegetation, on the campus of the University of Passo Fundo, through geoprocessing technics , correlated to the existents arboreal specimens, over the purpose to comprehend its relation with environmental sustainability and the implications for the users of the campus.

2 METHODOLOGY

The research was developed on the Campus I of the university of Passo Fundo, located in the city of Passo Fundo, in the northern region of the state of Rio Grande do Sul, Brazil. The university counts approximately 22 thousand students, distributed into 60 courses of graduation, dozens of specialization, master's and doctor's degree.

2.1 Spatial vegetation distribution

To evaluate the arboreal formations present in the urban area were obtained high-resolution images, derived from the QuickBird satellite. These images have a high spatial resolution panchromatic 0.6 m and multispectral of 2.4 m.

Aiming to raise all rivers and streams in the present area of study, we sought to obtain georeferenced data available and to provide quality. The data used for this survey were obtained through the Continuous Vector Cartographic Base of Rio Grande do Sul (HASENACK, 2010). This database allowed to obtain a mesh in vector format (. Shp) with full coverage of the study area at a scale of 1:50,000.

2.1.1 Used software

To conduct the survey of the areas of APP and vegetation cover of medium and large sized was used the software suite of ArcGIS 10, which allows you to manage and operate with spatial data (ESRI, 2012).

Within this suite were used applications ArcCatalog, which allowed the organization of the data base of this study, and ArcMap, responsible for performing space operations, such as creating buffers and classification of images, from the data obtained.

2.1.2 Extraction of Data Base and Classification of the Images

After performing the delimitation of the study area was performed a extraction of data base within defined limits, so just kept the data pertaining to the study area.

The classification of the satellite images aimed at obtaining a mapping of areas with common characteristics within the study area. These areas were classified into four distinct classes, formations Arboreal, undergrowth, Buildings/Roads and hydric resources.

To realize this classification, we used a supervised classification technique, which classifies the original image into classes in accordance with a number of samples. These samples aim to obtain statistical parameters of the digital values of each band used of the image.

2.1.3 Calculations of Total and Partial Areas

Aiming to obtain the total values of the areas of each class of land cover, were realized the process of calculating areas of polygons present in each data set. This calculation of the areas was made inside the ArcMap, resulting in tables containing the total areas of each attribute, which were later used for the quantification of the arboreal vegetation into the university campus.

2.2 Survey and quantification of the arboreal specimens

The forest area inside the campus I were inventoried taking consideration those examples with at least 0,10 m of DCH (Diameter at Chest High).

The examples were located at maps for documentation and register. The identification were made with loupe, consult to works of authors of the area (Backes & Irgang, 2004, List of species of the flora of Brazil**,** 2015), comparing examples of files and consulting specialists. This survey took the whole campus I characterization.

3 RESULTS AND DISCUSSION

The Campus I from the University of Passo Fundo, for being a great area provided with vegetation, can be considered one urban park due to its size. The vegetation of the campus has been a concern by the administrators, which is an important green area regionally. Into this space, were introduced arboreal species that characterize as rich and diversified, result of the introduction of different species during its 45 years.

Thus the University of Passo Fundo with the purpose of fulfill its function of social responsibility and worried about the environmental questions, has stimulated the implantation of green areas and the preservation of permanent preservation areas, on Campus I with the development of an environmental educational program destined to the academics, professors and general community, aiming maintain the biodiversity, regulate the water flux and absorb CO2, contributing to the sustainable development.

3.1 Distribution of the vegetation on the Campus

On Figure 1 can be observed the image of the Campus I after its supervised classification, the arboreal concentration is bigger at the southeast area, where is also found the biggest quantity of buildings, this shows a planning in relation with the campus arborization, since that the area with the bigger concentration of buildings is the most frequented area by the people, influencing directly on the physical and mental health of them. Besides that, this vegetation favors the infiltration of the regarding water from rain, knowing that on this area the location of the buildings and roads, lower the capacity of runoff in the soil.

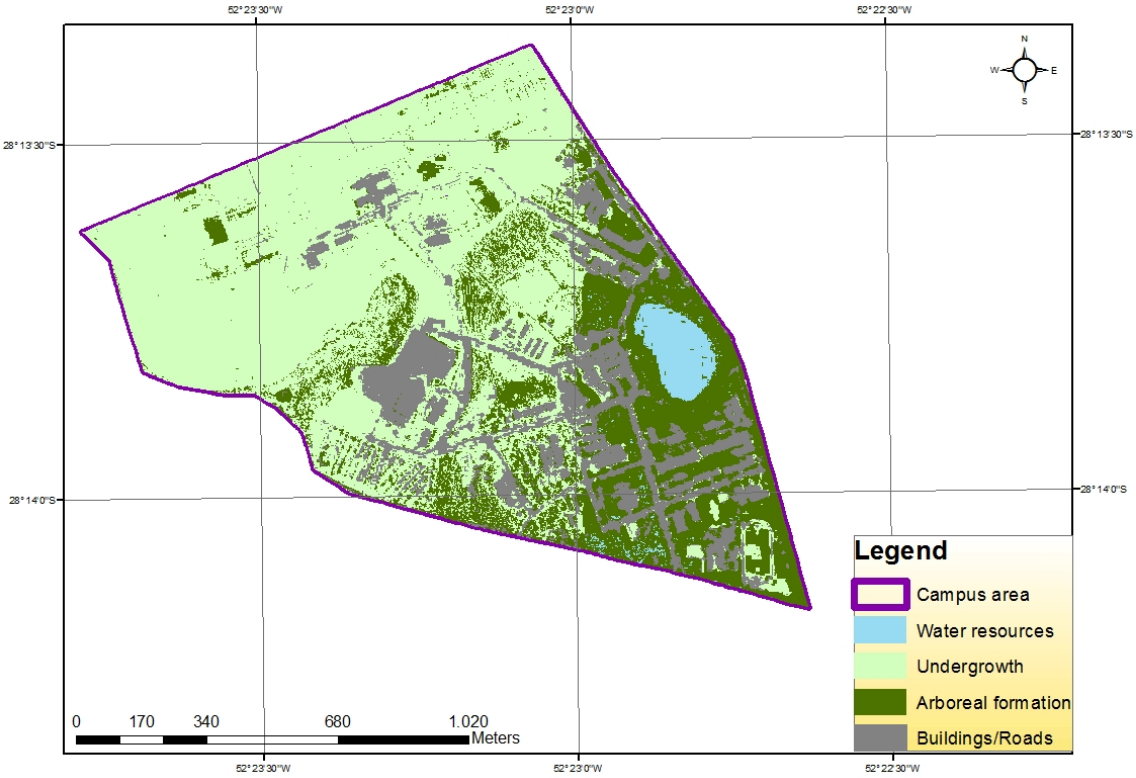

Figure 1: Classification of the soil use on the Campus I of the University of Passo Fundo

This survey showed that the total Campus area is 146,25 ha, being this distributed into 36,21 ha of arboreal formation, 80,42 ha of undergrowth, 25,95 ha of buildings/roads and 3,66 ha of hydric resources. The part of arboreal formation on the Campus correspond to 24,76%, the undergrowth 54,99%, buildings/roads 17,75% and hydric resources 2,51% (Figure 2). The part of undergrowth is bigger due to the existence of annual crops fields on the north area of the Campus.

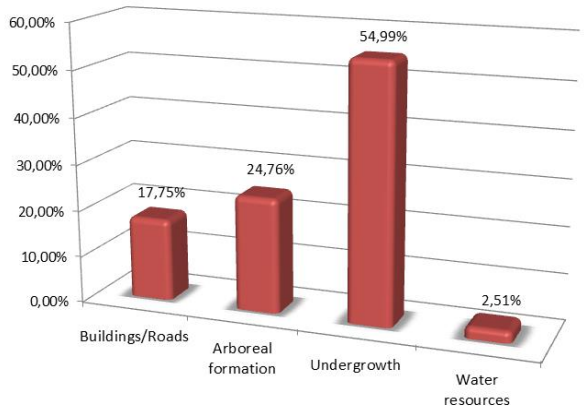

Figure 2: Percentage of the soil use on the Campus.

3.2 Arboreal species present on Campus

Historically, most of the Brazilian city had, its growth, whether on the urban or rural middle, without considering the environmental questions on the municipal planning. The natural vegetation, on most of cases, were being Substituted by the city or by the agriculture (Pancher, 2012). The Campus I of the University of Passo Fundo were agriculture area where were build the edifications and implanted the arboreal vegetation, into a way to create green zones reducing the impact of urbanization, allowing the access and the contact of the people with the nature to promote the better quality of life, that come in the same way with the studies in which shows that having the contact with the nature, help to promote the health and the well-being of the users that had access to the gardens or parks (Maller, 2005).

Were found over than 102 different arboreal specimens, with about 4100 examples, being distributed over the whole area of the campus, this way favoring the benefits that they bring, influencing the microclimate and raising the air humidity through the evapotranspiration, propitiating a favorable environment to the users, and allowing that the waters from the rain infiltrate the soil attenuating the fast runoff, that is one of the factors in which aggravate the flood and inundation formation (Figure 3).

According to Melo et al., (2010) in a study realized at the Campus I of the university to evaluate the influence of vegetation into the water infiltrate capacity in the soil, were obtained coefficients of 88L/m².day for native forest soil, 60L/m².day no vegetation soil, 77 L/m².day Eucalyptus sp. Soil and 75 L/m².day grassy soil. The two biggest permeability were obtained on the covered soil by the native vegetation and the Eucalyptus sp., because with the presence of vegetation the soil stay with better structure, becoming easier to infiltrate. The soil without vegetal cover obtained the lower permeability, for being compact and don't having root system that serves as preferred way to the water. This shows the importance of vegetation on relation with the lower of floods, because the soil with low permeability corroborates with a higher and faster superficial runoff, implying on the floods and inundation.

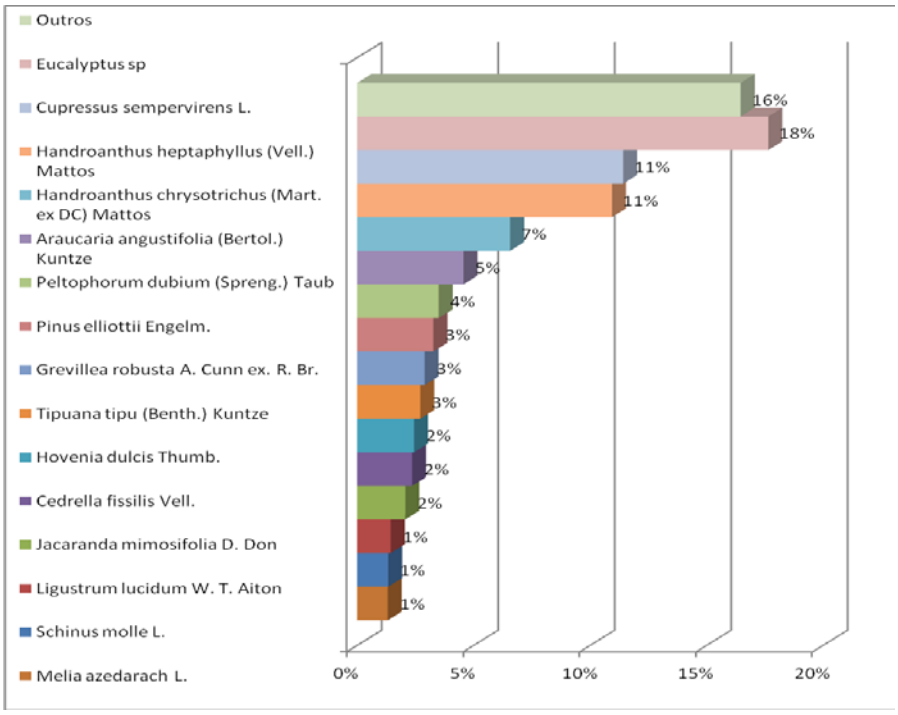

Figure 3: Distribution of the principal specimens found with major frequency on the Campus I, 2014

The two specimens found with major frequency Eucalyptus sp and Cupressus sempervirens, are exotic specimens used as wind and sound barrier. The concern with the conservation of the native flora is changing the scenery with the implantation of native specimens at the landscaping composition, emphasizing the importance to use the theory and practice, indicating sustainable practices that the academics can use on the professional exercise, aiming to ally the knowledge into a way to integrate the use of natural resources and build space. There is a tendency on the urban arborization planning in contributing to the specimens diversity, specially the use of native specimens, because lower the risks of environmental instability due to the influence of exotic specimens in the biodiversity of ecosystems and influence into a positive way on the fixation of the local fauna (Pereira et al., 2005).

4 CONCLUSION

The vegetations are an important piece for the people that live and use the artificial environment, avoiding the decline on the urban life quality and contributing to the sustainability. Because of that, there is the need to plan that artificial environment, creating alternatives to the vegetation in a way that the users of this environment don't suffer consequences of the lack of planning.

With the analysis of the images were possible to identify, quantify and classify the soil use, generating date for the administration of the campus to develop policies aiming sustainability, preservation, conservation and recovery of the environments, as well subsidies to include the key plan to integrate the theory with the practice into a harmonic, responsible way and emphasizing the sustainable development, by future projects with the academics.

The exchange of knowledge between the academy and the community allows sustainable actions into a way to reduce the environmental impacts, searching one fair society and environmentally correct, where the university has the main role into the environmental management.

Through future projects the integration of the education, the research and the extension, allows that the academic develop abilities, differenced perception of the middle and the surrounding related to the environmental work integrated with the environmental sustainability.

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