

THE ESSENTIALITY OF GREEN SPACES IN URBAN LANDSCAPES

A GREENWAY STUDY FOR
CAMPO GRANDE, MS - BRAZIL

A ZÖLDFELÜLETEK JELENTŐSÉGE A VÁROSI TÁJBAN

A BRAZÍLIAI CAMPO GRANDE VÁROS ZÖLDÚTJÁNAK ESETTANULMÁNYA

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[HTTPS://DOI.ORG/
10.36249/59.3](https://doi.org/10.36249/59.3)

ABSTRACT

The quality and quantity of UGS¹ are essential to urban landscapes, being directly related to the positive impacts on urban health and well-being. Additionally, UGS could help combat urban ill and improve life quality. This paper presents an investigation of the emerging concept of greenways, river restoration definitions, methodology and strategies, focusing on how it can benefit urban life and environment. Additionally, it proposes a greenway alongside the Anhanduí river in Campo Grande - Brazil. Based on relevant literature review, systematic field assessment and local regulations analysis, this study addresses six main issues: erosion and landslide, flood control, lack

of connections (ecological, visual and functional), ecological degradation, loss of identity and strategies to improve ecological values. Even though Campo Grande was referred to as the 2nd most forested city in Brazil, in addition to being internationally acknowledged as one of the 68 Tree Cities of the World by FAO² and the Arbor Day Foundation in 2019, preliminary evaluations indicated severe neglect at the river's riparian zone. Furthermore, these shortcomings affect the UGS and, inadequate landscape planning or lack thereof, indicates hazard to both urban infrastructure and citizens. Nevertheless, the site accommodates copious improvement possibilities, that can be seen with the presence of fish species, as well as various birds, tortoises and capybaras. Furthermore,

¹ UGS is the acronym for Urban Green Spaces

² Food and Agriculture Organization of the United Nations

the results show an increase of greenery, changing the character of the river from a men-made character to a more natural or nature-like feeling. With proper planning and maintenance, the abovementioned priorities can be maintained and enhanced in the future, hence this research utilizes greenway strategies with river restoration approach to promote urban health while conserving natural values, restoring habitats in an active way, improving accessibility, restoring degraded riparian zones and introducing new functions.

Keywords: Greenway, urban health, ecosystem services, green infrastructure, Anhanduí river

1. INTRODUCTION AND AIM OF THE STUDY

Cities can be considered landscapes (Turner, 1996) and are becoming congested and polluted in an ever-increasing pace (Blanco et al., 2009). According to the United Nations' Department of Economic and Social Affairs (UN DESA), 55% of the world's population lives in urban areas, and such is expected to reach 68% by 2050 (United Nations, 2018). Whilst these statistics are growing, considerable research attention has been drawn towards the issue of urban greenery, provided their fundamental role in the cityscape and urban health (Endreny et al., 2017) (Lohr et al., 2004). It has been proved that urban green spaces (UGS) can impact the environment and well-being in urban centres, such as with the improvement of air quality, decrease in temperature and overall positive impact to daily

life and wildlife habitat (Scott, 2015) (Nowak and Dwyer, 2010). Furthermore, some research shows that greater biodiversity in such spaces can greatly increase the psychological benefits of UGS (Fuller et al., 2007). In addition, according to the EU Water Framework Directive, river restorations can promote healthier and more resilient ecosystems.

In this perspective, this study aims to analyse relevant literature concerning the emerging concept of greenways and river restoration approaches in order to identify its impact on the urban landscape. It further seeks to apply the acquired knowledge by proposing a strategy for a greenway in the Anhanduí river, located in the Brazilian city of Campo Grande. In addition, it will address six main issues of the chosen site: erosion and landslide, which have become a serious issue due to the rain seasons combined with the municipality's neglect; flood control, since due to environmental changes seasonal floods are occurring in a crescent frequency, being also a result of bad shore engineering and the decrease of active surfaces; lack of connections (ecological, visual and functional); ecological degradation, caused by years of neglect and deforestation; loss of identity and strategies to improve ecological values and greenery level.

2. LITERATURE

Campo Grande is the capital city of Mato Grosso do Sul, one of the 26 states in Brazil, counting with an estimated population of 2.809.394 people in the whole state (IBGE, 2020). Located in the Midwest part of the country, the

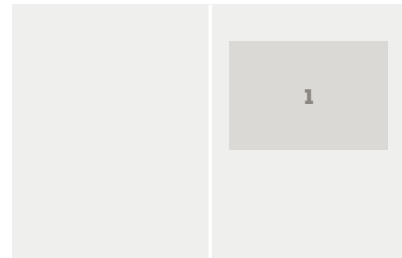


Fig. 1: Research site in Campo Grande (IMAGE BY CAMILA ROSA / REPRODUCTION: GOOGLE MAPS)

city consists of 8.092,5 km² in territory, from which 154,5 km² corresponds to the urban area. For means of reference, the size of Budapest corresponds to only 6,49% of Campo Grande. However, the Hungarian capital has a total of 1.756 million inhabitants (United Nations, 2016), whereas Campo Grande has an estimate of 906.092 (IBGE, 2020), though with the potential to house 4 million people (Arruda, 2016).

2.1 Urban Analysis

On June 21st of 1872 a caravan coming from Minas Gerais³ arrived and José Antônio Pereira established the first settlement. The village's first boundaries were defined in 1875 and named "Arraial de Santo Antônio do Campo Grande" in honour of St. Anthony and the 'large field' they were located at (literal translation for 'Campo Grande'). In 1910 the county was created and the modernizing ideas of the first administrators influenced several areas, from livestock to urban planning, where the urban zone was traced with broad, tree-lined avenues and streets. The urban fabric was developed between the streams Prosa and Segredo, with the purpose of occupying the tabular forms of the lands with an orthogonal plan, in chess, with wide east-west streets (Junior, 2009).

Situated between the Tropics of Capricorn and Equator, Campo Grande has variable temperatures throughout the year with a predominance of tropical savanna climate with dry seasons, where only two seasons can be clearly identified: summer and winter. Summers are long, hot, stuffy and humid, with a high level of rainfall, with the maximum average daily temperature above 31°C. Winter is considered

the cool, fresh and dry season, lasting 2 to 3 months with the maximum average daily temperature below 28°C. In recent years lower temperatures were registered, reaching 2°C at night (Clima característico em Campo Grande, Brasil durante o ano - Weather spark; Campo Grande, Brazil Monthly Weather Forecast - weather.com).

The topography of Campo Grande and within a 3 km perimeter contains only small variations of altitude, with maximum change of 106 meters and average altitude above sea level equal to 575 meters. There are four soil types covering the municipality, the predominant being the dark red Latosol, which extends from the upper part of the municipality to the border of its territory with Ribas do Rio Pardo and Rio Brilhante towns, in the confluence of the rivers Anhanduizinho and Anhanduí, the latter being the researched site. At the same time, it is accompanied by a wide range of Quartz Sands, which descends in the same direction (Perfil Socioeconômico De Campo Grande - Mato Grosso do Sul, 2017) (Dieckow et al., 2009). Campo Grande belongs in the neotropical zone in the domains of the Cerrado phytogeographic region, constituting a set of vegetation forms that are presented according to a biomass gradient, directly related to soil fertility. The main physiognomies of this vegetation forms are the Campo Limpo, Campo Sujo, Cerrado, Cerradão, in addition to the presence of the Alluvial Forest (riparian forest) and areas of ecological tension, represented by the contact between the Cerrado (Seasonal Semideciduous Forest) and areas of anthropic formations used for agriculture (Neto et al., 1994) (Pott et al., 2011) (Eiten, 1972).

3 Minas Gerais is another Brazilian state, located between Campo Grande and the Southeast coast



2.2 Anhanduí River

The Anhanduí river is the biggest watercourse crossing the city in a NE/SW direction. The spring is situated in the Northeast of Campo Grande and it flows to the Southwest, reaching the end of the urban perimeter and moving deeper into the state.⁴ This study selected approximately 6.2 km of the waterbody, starting from Afonso Pena Avenue, going through Ernesto Geisel Avenue and stopping at Ezequiel Ferreira Lima Avenue. The site's width varies from 17 to 70 meters in approximation, which includes the riparian zone. This variation is due to the urbanization process and construction of the roads. The site is also situated between the two existing Anhanduí Ecological parks, besides being an area with abundant research potential, thus the reason it was chosen for this study (Anhanduí linear park, a greenway proposal for the city of Campo Grande, 2019).

Historically the river had a vital role, being used as a source of drinking

water for animals and humans, irrigation of crops, fishing and recreation. With the city's development the river lost these functions and started being treated as sewage drainage, action that led to major ecological damages. As a result of the ever increasing and disorganized urban sprawl that have been occurring for the past 60 years, the character of the river changed completely, going from around a 95% natural environment to an almost 100% artificial character, with engineered, man-made concrete structures and none of the original character left. Overall, it is possible to say that nowadays the profile of the site is a traffic way, heavily used and of extreme importance to the road structure of the city (Anhanduí linear park, a greenway proposal for the city of Campo Grande, 2019).

2.3 Urban green spaces (UGS)

The elements composing the urban landscape is a combination of surfaces, buildings and vegetation (Ridd, 1995), hence

4 MS state is the acronym for Mato Grosso do Sul, from which Campo Grande is the capital city

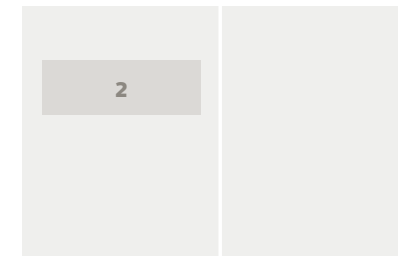
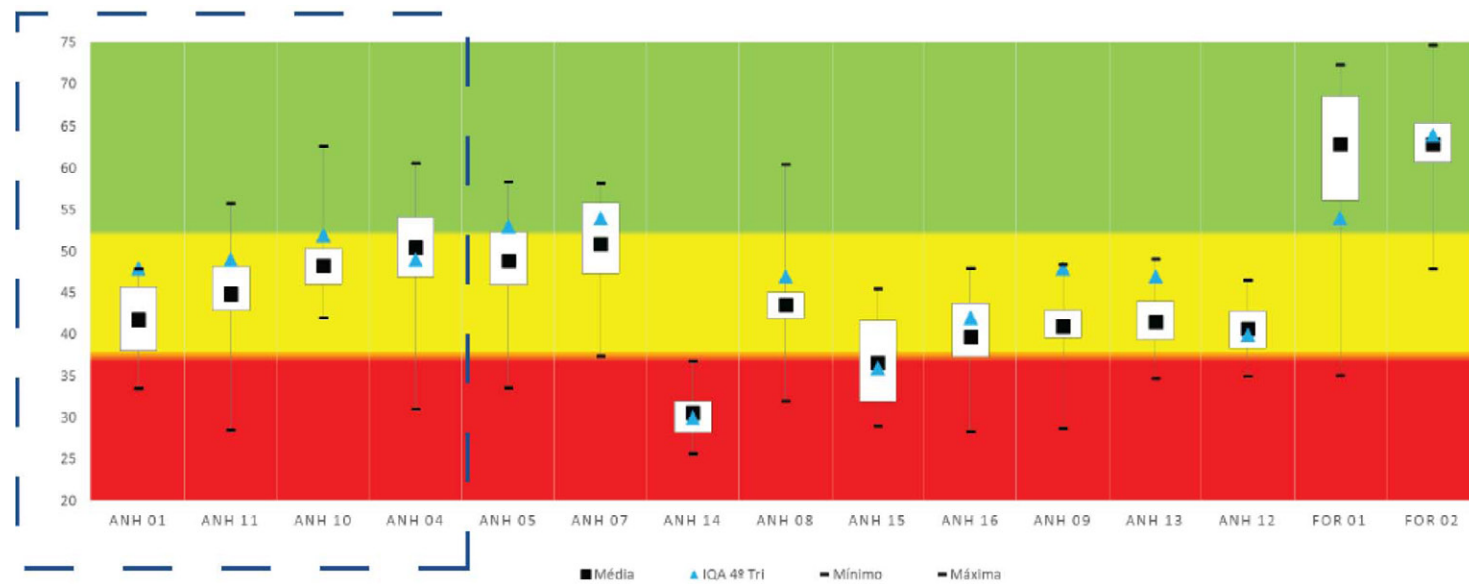


Fig. 2: Box Plot chart: average, maximum and minimum of the Water Quality Index. (ADAPTED FROM "QUALIDADE DAS ÁGUAS SUPERFICIAIS DE CAMPO GRANDE - MS" BY SECRETARIA

MUNICIPAL DE MEIO AMBIENTE E GESTÃO URBANA, 2017, P. 71)

the essentiality of urban green spaces in the city. There are many professional terms to identify types of green spaces. Focusing on UGS, they can be simply defined as a green surface covered by plants, therefore being considered biologically active surfaces. They can vary in size, type, vegetation coverage, biodiversity level, environmental quality and location. Moreover, "urban green spaces provide a wide range of ecosystem services that could help combat many urban ills and improve life for the city dwellers - specially their health" (Wolch et al., 2014, p. 324). Within a more systematic approach, UGS can be divided into two categories: public, which includes parks, cemeteries, sporting fields, natural reserves, streams and riverbanks riparian zones, trails, greenways, street trees, conservation areas, green walls, trails, community gardens and alley ways (Roy et al. 2012); and private, consisting of corporate campuses, private backyards, apartment buildings and communal areas (Wolch et al., 2014).

Greenway (a linear green space type) has become an emerging approach in landscape planning in the past few years (Ahern, 2002). Therefore, it is of extreme importance to fully

understand the characters and specifications behind the name, as well as how to strategize and to create typologies a project in order to plan efficiently.

3. MATERIALS AND METHODS

According to the new urban master plan of Campo Grande, the research site is located on seven neighbourhoods (Amambai, Taquarussu, Jacy, Jockey Club, Piratininga, Guanandi and Aero Rancho); two zones (Z1, Z3); two macro zones (MZ1, MZ2); two environmental zones (ZA1, ZA3); one special zone of cultural interest - spot (ZEIC 4); two special zones of cultural interest - poligon (ZEIC 1, ZEIC 2); two urban regions (Centro and Anhanduizinho) (SISGRAN, n.d.). Furthermore, the river is located in between two of the most important avenues in the city, Ernesto Geisel, where vehicle traffic is intense in both directions.

The methodology consists of a pragmatic approach based on international literature review on urban green spaces and the ecosystem services they provide, field assessment of the selected area of the Anhanduí river, and usage of landscape architecture planning principles

and strategies, data collection and an exploratory and analytical research of the city of Campo Grande. Following, the execution of specific site analysis in the Anhanduí river, performed in person in January 2019, utilizing a field assessment form elaborated by the academic. Due to the length and different profile of the selected area, the site was divided into four sections (Fig. 1), and those sections were subdivided according to the number of bridges and character it presented. In total twelve subsections were created, envisioning the facilitation of data collection and assessment.

In order to assess all the necessary categories of the site, the field assessment form aforementioned consisted of data regarding the width of the river and riparia area, height of retaining walls, visual character, vegetation type and quantity, socio-economic profile, land use profile, quality of urban infrastructure, ownership of UGS, degradation level, potential hazards, presence of fauna, water level, among others. Detailed sections were drawn as well for each sub-section.

Regarding the water quality, this research considered the data from the governmental project called "Clean Stream Program", launched in 2009.

The program consists of a water quality monitoring network to evaluate the trend and suitability of water use for public supply, through the application of a numerical indicator called the Water Quality Index (IQA CETESB), adapted by the Environmental Company of the State of São Paulo. The chosen site for this study is situated in parts ANH 01, ANH 11, ANH 10 and ANH 04 of the river. The water quality in the river was rated as 'regular' (yellow) in most parts, with a few places rated as 'good' (green), located outside the urban perimeter (Fig. 2) (Secretaria Municipal de Meio Ambiente e Gestão Urbana, 2017).

4. RESULTS AND DISCUSSION

Resulting from the preliminary research of green spaces at the proposed site, focused on the riparian area of the river, both private and public ownerships could be found in the area, the majority being publicly owned land, especially alongside the watercourse. Among them, there are two Anhanduí Ecological parks, a historical square, two sports fields, an ecological protected area belonging to the Federal University and small irregular 'private' gardens



Fig. 3: Diagram highlighting overall approach and sectorization (IMAGE BY CAMILA ROSA / REPRODUCTION: GOOGLE MAPS) (IMAGE BY CAMILA ROSA)

claimed by the citizens in publicly owned land in the riparian zone. Furthermore, approximately seven unused lots could be identified in the close surroundings. In concerns of the existing ecological scenario, it can be described as precarious with improper plant application and maintenance. The riverbed and riparian zones are degraded presenting many erosion spots, discarded litter near and inside the water, water pollution and destruction of habitats. Additionally, in many parts, especially in sections two and three, almost all the original vegetation was cut due to an ongoing engineering project to rebuilt and create new retaining walls.

It could also be observed that the urban densification deviated the fauna and flora away from cityscapes by destroying their natural habitat besides reducing and extinguishing their food sources, having a massive impact on the natural environments worldwide (Corral et al., 2021). In contrast to this global tendency of heavily built up cities, Campo Grande still has well distributed horizontal and vertical built areas intertwined with considerable amounts of urban forestry, and it can be said that in the past few years more and more animals and plants have been seen in the urban environment. The Anhanduí river surroundings can, in some level, be considered an important ecological place in this regard, even though the urbanization process damaged the ecological balance of the area, some species can still be seen in some parts of the site. Even though the water is polluted, some fish (*Tilapia*, *Cyprinus carpio*, *Loricariidae*) species can still be found in the shallow waters, as well as various birds, tortoises (*Chelidae*

species) and capybaras (*Hydrochoerus hydrochaeris*) city (Anhanduí linear park, a greenway proposal for the city of Campo Grande, 2019).

4.1 Character

Further analyses showed that the character of the river and surroundings changes throughout the selected part, going from a men-made character with the channelized river, in section one, to a more natural or nature-like feeling, with the artificial structures decreasing and more vegetation appearing in section 3, which can be already noticeable with the cooling in temperature. At this stage, it can be said that there is approximately 90% artificial character in section one, due to the concrete engineering structure covering the entirety of the river bottom, bed and most of the riparian zone, whereas section two is approximately divided in a 60% - 40% ratio of man-made and natural surfaces. On the other hand, section three could be described as 85% natural and section four as having approximately 95% natural, containing only a few old concrete small retaining walls hidden among the vegetation, besides the steel concrete structures underneath the bridges. Even though these proportions were not calculated with specific mathematic formulas, the overall conclusion is that in a Southwest direction, the artificiality of the river decreases (Pic. 1).

4.2 Greenway planning strategy

Considering the challenges and possibilities of the area to accommodate all the changes needed without disrupting the ecological aspects and losing natural values, the planning strategy is (Fig. 3) to conserve the existing values, provide

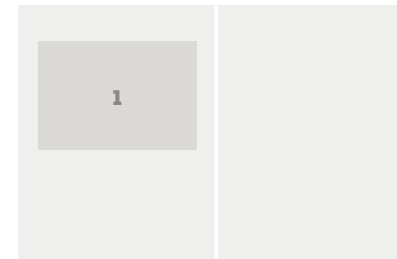


spaces for natural river dynamics processes (where possible) by getting rid of some artificial structures and let it restore itself by supporting natural succession and regeneration processes in a natural way, create connections, restore the native vegetation, improve accessibility restore habitats in an active way and create possibilities for recreation. The connectivity and functionality will unify the space, having a bike and pedestrian, encompassing more transportation possibilities in the area. In addition, each of the four areas demands a different approach, hence the functions and character will differ. In parts 1 and 2, a walking path, sitting areas, dog park and ecological restoration are to be considered. Part 3 would contain mainly walking paths closer to the water, sitting areas and replanting of native species. Part 4 is yet to be defined, but it has the potential for ecological purposes.

Furthermore, this strategy would help achieve better results for the main issues mentioned previously. For instance,

reducing the traffic by removing one of the traffic lanes, this approach of decreasing the biologically inactive surfaces, there would be more space to accommodate the river by increasing the riparian zone. It would also make it possible to create slopes with more subtle angles in order to decrease erosion and landslide. This would also make space for the creation of pedestrian and cycling ways. During the field assessment eight potential green spaces were discovered, varying in size, quality and type. Some of the areas were just abandoned lots without any vegetation, while others were small squares/parks with a few trees and grass cover (a common profile of neighbourhood green spaces in Campo Grande).

In regards of the site itself, the ecological approach would be to increase green coverage, create the ecological connection to the ecological park, make use of bioengineering techniques to prevent erosion, such as use of living plants, brush mattress constructions,



Pict. 1: Study site overall character changes by sections

use of geotextiles, Wattle (wicker) fences in order to secure the top layer until the area in between is fixed by the planted vegetation (Donat, 1995). Create terraces and slopes with subtle angles in sections 2, 3 and 4, in addition to erosion control blankets and vegetation, placement of wooden trunks on the river bed in the more natural places such as in section 4, use of stones to reduce water speed in all four sections. In section 4 it would be proposed to, enlargement of the river bed in section 4, therefore providing space for the river to restore itself in a natural way, reintroduce native plants from the Cerrado, reintroduce animal species, specially fish since they are the most important and realistic to the situation, besides using and use plants with good smell in the parts with sewage odours.

To prevent floods, reducing the water speed and enhancing the quality of the water, the planning strategies presented so far would help in these aspects. By reducing the car traffic

and providing more space for the river and increasing the riparian zone, the biologically active surfaces would increase, providing more room for the rain water to be absorbed. Additionally, the shore reconstruction and restoration, erosion control measures and the insertion of appropriate plant species to the riparian zone, the amount of sediments that would end up in the river would decrease considerably, contributing to higher quality of the water. Moreover, these strategies would help prevent floods, by having floodplains areas and more space for the water to flow before reaching the street level.

5. CONCLUSION

This paper has examined the issues found in the Anhanduí river site and its environs, in order to perceive the situation and foreseeing the possible greenery enhancement and urban health improvement in the city of

Campo Grande, by applying a strategy based on greenway and river restoration approaches. In this perspective, it can be concluded that as a preliminary analysis, the results can be considered promising and instructive. Taken together, the study led to the conclusion that firstly, the green spaces analysed does not present the necessary requirements to be considered effective and beneficial. Furthermore, the lack of proper planting design, the inexistence of specimens in some places, the neglect of empty lots, the engineering project, inexistence of functions, lack of maintenance and stewardship results in aesthetically unpleasant places, in addition to creating hazardous situations, such as landslides, erosion, hideout for criminals, propitious places for discarding litter and residues.

Even though section has more inactive surfaces and less space for interventions, it contains many fruit trees and presents the challenge of transforming the character by restoring the natural character of the river as much as possible. Furthermore, the existing species in this extensive area, could be good considered solutions for urban environments since they are resistant. Sections 2 and 3 presented the largest damage regarding the vegetation, since they were being cut off for the reconstruction of the retaining walls. Nonetheless, the wide riparian area alongside the adjacent green places sorted in the surroundings, has a high potential for ecological restoration and green spaces connectivity, which can later be extended to other parts of the city. Section 4 showed the highest ecological potential together with the need for maintenance and appropriate plant design, in order to

provide a high-quality green space for the inhabitants, animals and birds.

By applying these techniques, some of the expected results would be the improvement of the water quality, use of floodplains to help prevent floods, decrease of temperature in the surrounding areas, habitats would be restored or created, the site would have different atmospheres to be experienced by the people, reduction of erosion and landslide problems, the reduction of traffic in section 4 would extend the riparian zone increasing the green coverage, creating and improving habitats and creating the ecological connection between the ecological park and the river. Additionally, by dealing with the creation of pedestrian and cycling routes, the functional connections would also be improved and/or created. Overall, these actions would lead to a considerable increase in urban and environmental health. Overall, it is viable to affirm that the results may improve the knowledge about an efficient planning strategy of a greenway created by landscape architects, in the urban environment of Campo Grande. Furthermore, this study represents the potential enhancement of local literature, not only for academics and professionals, but to all citizens. ●

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A ZÖLDFELÜLETEK JELENTŐSÉGE A VÁROSI TÁJBAN – A BRAZÍLIAI CAMPO GRANDE VÁROS ZÖLDÚTJÁNAK ESETTANULMÁNYA

A városi zöldfelületek minősége és mennyisége alapvető fontosságú a városi táj szempontjából. Közvetlenül hat az emberek egészségére és jólétére, javíthatja az élet minőségét, és pozitív hatása lehet a betegségek leküzdésében. A tanulmány a zöldút, a folyók menti területek helyreállításának módszertanát és stratégiáinak kezdeti vizsgálatát, illetve azok lépéseit mutatja be. Arra összpontosít, hogy miként lehet a zöldút előnyös a város életére. A fókuszban a brazíliai Campo Grande város esettanulmánya, a várost keresztelző legnagyobb vízfolyam, az Anhanduí folyó és környezete áll. A területre vonatkozó szakirodalmi kutatás, a helyi szabályozás elemzése és a szisztematikus terepi értékelés alapján a tanulmány 6 fő kérdéssel foglalkozik:

- erózió és földcsuszamlás;
- árvízszabályozás;
- kapcsolatok, összeköttetések hiánya ökológiai, vizuális és funkcionális szempontból;
- ökológiai degradáció és identitásvesztés;
- az ökológiai helyzet javítását célzó értékek,
- valamint a növényzet szintje.

Annak ellenére, hogy Campo Grande-t Brazília második legerdősebb városaként említik, valamint a FAO és az Arbor Day Alapítvány 2019-es értékelése alapján egyike a világ fás városainak (Tree Cities), az előzetes értékelések súlyos elhanyagoltságot jeleztek a folyóparti zónákban. Ezek a hiányosságok kihatnak a városi zöldfelületekre. A nem megfelelő városi zöldfelületi tervezés és fenntartás veszélyt jelent a zöldinfrastruktúra, és végső soron a városi polgárok számára.

A terület rengeteg fejlesztési lehetőséget kínál. Megfelelő tervezéssel és fenntartással az említett prioritások a jövőben is fenntarthatók, helyreállíthatók az élőhelyek, a leromlott parti zónák, megőrizhetőek a város természeti értékei. Az Anhanduí folyó mentén kialakított új funkciók, a városi táj létfontosságú részeként ismét kapcsolatot teremthetnek a várossal és a városlakókkal.