The Role of Greenways in the Rebirth of the Urban Environment in San José, Costa Rica

Molina-Mainieri Maria Gabriela, Tashiro Yoritaka and Kinoshita Takeshi

Greenways are green corridors established along linear landscape elements such as rivers, canals, historical routes or railways designated for multiple purposes that can include recreation, transportation or conservation. Greenways have become a very popular planning tool to protect nature and landscapes while providing spaces for the residents’ enjoyment.

This study suggests that greenways and their benefits may help mitigate not only environmental issues but also diverse urban problems. It presents the municipal proposal for the development of a river greenway and a cycle route. A project that represents a significant opportunity to increase the amount of green areas of the locality for recreational and ecological purposes. The study also presents what is believed to be the main cause of the unsound conurbation and some of the most important negative effects it has had over the residents, environment and (city) development.

According to the results, many problems of the current urban model of Costa Rica’s Great Metropolitan Area could be positively influenced by the benefits of greenways. However, for greenways to be a valuable approach to successfully revitalizing urban nature, the concept must be correctly interpreted and adapted to the characteristics and necessities of each city.

1. Introduction

In most cities, urban sprawl and encroaching development represent a serious threat for the urban natural environment. Urban expansion is putting enormous pressure on both, inner and bordering green spaces; therefore, the increasing need for an urban plan with emphasis on restoring urban nature and protecting the surrounding natural areas.

A relatively new tool that is offering the opportunity to develop creative design guidelines for urban growth is the greenway planning strategy (Fábos, 1995; Diamond and Nooman, 1996; Conine et al., 2004). Greenways are strips of vegetated land with a wide variety of purposes that protect and connect green, cultural, and recreational spaces. Ahern (1995) provides one of the most recognized definitions of greenways: “greenways are networks of land containing linear elements that are planned, designed and managed for multiple purposes including ecological, recreational, cultural, aesthetic, or other purposes compatible with the concept of sustainable land use” (p.134). Greenways can be effective preservation tools at regional, local or neighborhood scales (Bryant, 2006).

Known in Costa Rica as linear parks or ‘fluvial corridors’, greenways have recently started to emerge as an attempt to restore the urban natural environment and to provide residents with new forms of recreation.

Costa Rica is the third smallest Central American country (population: 4,549,903 | territory: 51,100km²). Despite the scarce territory, it has a great wealth of nature, and a considerably large bio-diversity.

Costa Rica is divided into seven provinces. One of them, the province of San José, comprises twenty cantons of which the Canton of San José is the capital and most developed city of the country (population: 350,535 | territory: 44.6 km²). Although the city of San José represents the economic and political center of the country, the urban activity has extended beyond the city limits, reaching thirty other cantons and forming the Great Metropolitan Area (GAM) (population: 2,366,721 | territory: 1,967 km²).

Most of the GAM lies in what is commonly known as Central Valley. Volcanoes and other geomorphologic features of volcanic nature surround this area (CIA, 2009). This valley, as the rest of the country, presents landslides, and other threats of seismic and volcanic nature. In the Central Valley, the temperature oscillates from 15°C to 30°C (minimum and maximum annual average). Due to Costa Rica’s condition of tropical country, only two seasons exist: dry (from November to March) and rainy (from April to October). River basins, aquifers, forests, and other types of green spaces are among the most significant natural features of the region.

Although Costa Rica has been recognized as a country committed to the conservation of the environment, it has a contrasting reality. The urbanization process of the GAM has had a tremendous impact on the environment. It has contaminated rivers, eliminated much of the urban nature, and put considerable pressure on protected areas. Figure 1 shows how the green areas of the GAM have been pushed to the borders while centers have become emptier of nature.

In terms of loss of green spaces, the problem has mainly lain in the fact that urban nature has not been given the same importance as rural nature. Rural landscapes, such as national parks, protected areas, and
public and private forested lands are extremely valuable lands because they provide the perfect scenery for ecotourism. From around 1987 ecotourism started to grow in Costa Rica, and today it is the top income generator of the country (Acuña y Villalobos, 2001). Although the country attracts hundreds of thousands of visitors every year, most of them avoid San José and other urban areas as much as possible, for being disordered and unpleasant cities, but mostly for not finding there the main element they are looking for: NATURE.

This study sustains that the introduction of a greenway system in the GAM can provide a wide range of benefits that can help mitigate not only environmental issues but also other urban problems. The first objective of this paper is to build a theoretical framework by outlining the greenway’s background and benefits, as well as by providing a synopsis of the urban planning process in the GAM. The second objective is to present an overview of the municipal proposal for the development of the María Aguilar River (MAR) Greenway and Cycle Route Project. The third objective is to review the most critical issues of the present urban model of the metropolitan cantons. Lastly, to discuss: which issues of the current urban model are likely to be positively influenced by the existence of greenways.

1.1. Greenways’ background and characteristics

The origins of greenways can be traced back to the late 19th century, and it is Frederick Law Olmsted who has been recognized as the father of the greenway movement in the United States (Little, 1990 pp. 7-20; Fábos, 2004). Fábos (2004) identifies three main categories of greenways: (1) natural systems of great ecological importance, (2) recreational greenways, and (3) greenways with important cultural and heritage values. Greenways usually comprise both public and private lands, and can include diverse elements such as trails, natural features, historic structures, vacant urban lands or any other resources that are important to a community. The focus of greenways can vary from conservation through stream corridor protection, connection of parks and open spaces to expand recreational opportunities, or to promote revitalization of downtowns by providing green corridors or pathways, making the area more appealing to businesses and residents.

In general, greenways have the potential for providing a wide range of benefits in metropolitan regions (Luymes and Tamminga, 1995). The most important functions of greenways show how this planning tool can help:

A. *Protect natural resources and rural heritage*: this function is regarded as one of the most important. Greenways can help preserve natural corridors, enhancing wildlife and migration routes (Bueno et al., 1995). They are a useful planning strategy to preserve open spaces, improve water quality (Arendt, 1994; Conine et al., 2004), control flooding, and buffer the negative effects of development, noise and air pollution (PGPC, 2002).

B. *Promote economic prosperity*: the identified economic benefits of greenways are mainly related to increased property values. However, the promotion of corridors as recreational spaces is in fact what gener-
ates most of the revenue, especially from tourism, food, and other commercial opportunities (PGPC, 2002).

C. Preserve historical and cultural resources: greenways can integrate, promote and preserve important heritage and cultural values for the population (Fábos, 2004). Residents and visitors can have the opportunity to access sites of historic and architectural significance (PGPC, 2002).

D. Provide opportunities for recreation: although recreation is one of the most commonly known benefits of greenways, this function is often incompatible with wildlife preservation. Greenways that focus on recreational uses provide health and fitness benefits for the community (Smith and Hellmund, 1993; Conine et al., 2004). The recreational function of greenways also promotes human interaction by providing access to nearby localities and linking communities (PGPC, 2002).

E. Increase opportunities for education: Greenways’ potential to serve environmental education goals is as significant for the conservation of urban biodiversity as their role as natural habitat (Bryant, 2006). Greenways can be used as fields where people (especially children) can directly interact with natural, cultural, and historical community assets learning about the environment in a more entertaining way.

F. Shape community growth: greenways can be a useful tool to contain urban growth and define the urban-rural interface (Ahern, 1995). Greenways could help define development patterns and land uses to preserve valuable land (PGPC, 2002).

G. Enhance the aesthetic value of the landscape: as parks and green areas, greenways can aesthetically improve the appeal of landscapes (Hellmund & Smith, 2006). The aesthetic quality of greenways influences the perceptions of quality of life and contributes towards a sense of well-being (Chon, 2004).

H. Provide alternative transportation: this function depends mainly on the level of connectivity achieved by the greenway system. A route that offers options for non-motorized transportation benefits: (1) the city by reducing congestion, (2) the environment by decreasing air pollution, and (3) the residents by providing a healthier and safer environment (PGPC, 2002).

I. Improve connectivity: A network that connects a fragmented landscape can provide benefits for both wildlife and humans (Hilty et al., 2006). Greenway connectivity is understood as an aspect intrinsic to well-structured and cohesive greenway networks that help to both, (1) enhance the quality of life of the residents, and (2) provide opportunities for wildlife mobility.

1.2. Planning in the Great Metropolitan Area

In the GAM, planning efforts of past years have hardly been focused on protecting the urban environment. Therefore, attention to planning strategies such as greenways as potential tools to protect natural corridors has been insufficient. In the GAM the accelerated low-density sprawl resulting from the deficient city planning is producing a series of problems that are having economic, physical, and environmental consequences. Air pollution, noise, traffic congestion, sewage contamination, loss of open public spaces are just some of the issues Brenes (2006) considers that make the urban development model of the GAM irrational and unsustainable. Although there have been initiatives to improve the conditions of the region, what has been lacking is the will to carry them out correctly. Among the most significant urban planning efforts of the last sixty years it is worth emphasizing:

- 1954: the establishment of INVU (National Institute of Housing and Urbanism), created in an effort to institutionalize the Costa Rican urbanism (Klotchkov, 2003).
- 1949: the creation of the Plan for the Capital of the Republic of Costa Rica. This plan introduced the concept of ‘metropolis’ with satellite cities into the city of San José. It also proposed a functional but orthodox zoning of the territory.
- 1976: the creation of the Plan Drenaca. This plan, on the contrary, criticizes the concepts proposed by the previous plan and analyzes the advantages of a mixed land use as well as different development options such as: ‘central city’ and ‘parallel city’.

As described by Klotchkov (2003), these two plans (1949 and 1976) were promoted by the Municipality of San José but created by international planners. However, neither of them was implemented.

- 1982: the creation of the first and most important proposal to control the development of the Great Metropolitan Area: Plan GAM (Regional Plan of Urban Development of the Great Metropolitan Area) by INVU. According to Brenes (2006), this plan became rapidly outdated due to some of its social policies and its inability to decelerate urban sprawl. Plan GAM proposed the guidelines for the development of the region having, as main purpose, the control of urban expansion through land use regulations. The map of this plan (Fig. 2) shows a larger amount of agricultural land with green patches in the periphery. It included three major categories of land use: green areas (e.g. national parks, recreation, protection areas), agricultural areas, and urban development areas.
- 2001: the creation of PNDU (National Plan of Urban Development). A plan introduced in order to improve the situation of the GAM developed in three phases:
  a. Phase I: comprised fifty-four workshops on eight different subjects (urbanism, environment, housing, transportation, energy, social processes, legal, and water resources). This first phase obtained the participation of more than one thousand people of diverse institutions and citizens that enabled to envision the new urban model. An important characteristic of PNDU has been its interest in providing changes in the urban setting to ensure the development of a "city for the people".

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Open and multi-sector participation in all three phases of the plan incorporated the following elements: (1) information dissemination, (2) consultation, (3) collaboration, and (4) empowerment.

b. Phase II: this phase consolidated the previously established vision of the project. It analyzes different proposed plans and started formulating the project PRUGAM. It was also considered vital to strengthen planning and management tools both at municipal and central governments.

c. Phase III: as a result of the two previous phases, it was decided to examine Plan GAM. From this examination emerges Plan PRUGAM (Urban and Regional Plan for the Great Metropolitan Area). Financed by the European Union (60%) and the Costa Rican government, the main objective of this plan is to reform the Plan GAM by proposing changes on seven different urban systems: (1) Urban Environmental, (2) Transportation and Roadways, (3) Infrastructure and Networks, (4) Urbanism and Housing, (5) Social, (6) Economic, and (7) Legal Institutional (PRUGAM, 2008).

Plan PRUGAM [Fig. 2 (Right)] reassesses the distribution of the land and presents a different planning proposal. This plan proposes new boundaries for the GAM (sectors I, II, III). With the purpose of protecting the natural areas and its wildlife, it recommends the creation of three main biological corridors (North Corridor, East Corridor and "Unifying Mountain Ranges" Corridor).

A project of Plan PRUGAM’s Urban Environmental System that is highly related with the study subject of this research is 'Trama Verde' (green weft) [Fig. 3]. The aim of this project is to utilize river corridors, streets, and rights-of-way of railroads to create biological corridors, cycle routes, pedestrian boulevards, and greenways to connect the green spaces scattered over the region.

One of the most important differences in the environmental field between Plan GAM 1982 and Plan PRUGAM 2008 is that the latter shows a deeper understanding of the importance of preserving urban nature. It introduces significant physical and conceptual changes, giving a more leading role to the regional natural features, considering and utilizing them as an integral part of the urban restoration.

2. Methodology

This study is based essentially on document review. It includes the examination of existing literature such as journal articles, books, academic studies, municipal reports and newsletters. In order to carry out the study in a systematic way, we have divided it into three sections:

- Overview of the María Aguilar River Greenway. In this part of the paper we review the most important aspects of the project; its significance as a tool to provide opportunities for alternative transportation,
recreation, as well as regeneration and protection of urban nature. Reviewing the most critical issues of the current urban model of the GAM. In this part of the study, we extract a wide variety of issues that -according to different authors- are affecting the GAM. Subsequently, the problems are compared and analyzed to identify the main cause and its effects over residents, environment, and development. Discussing the possible effects of greenways over the urban problems found. In this last section, we will try to answer the following question: Which problems of the current urban model could be positively influenced by the benefits of greenways? For this purpose we will utilize a contingency table to compare the urban problems of the GAM and the benefits of greenways to determine the possible outcomes.

3. Overview of the Maria Aguilar River Greenway and Cycle Route Project

The María Aguilar River (MAR) greenway and the cycle route were proposed to connect the green spaces and parks of four cantons of the GAM. The project was developed by the municipalities of La Unión, Curridabat, Montes de Oca, and San José. Jointly, the territory of the four cantons covers a total area of 120 km² [Fig. 4] (MSJ, 2004). Although this project has not been implemented yet, it represents one of the first endeavors to introduce a local greenway to provide new forms of recreation, transportation and ecological revitalization among other functions (Figure 5 shows the relation of this project with Plan PRUGAM).

The MAR flows from east to west crossing three of the four cantons (La Unión, Curridabat, and San José) extending for approximately 21.5 km. The cycle route, on the other hand, deviates from the MAR corridor, following the railway, passing through the cantons of Curridabat, Montes de Oca, and San José. Although some of the native flora and fauna of the MAR still coexist within the urban setting, they have been affected by urban sprawl. This river corridor has been transformed into a sequence of natural patches seriously contaminated and deforested.

The feasibility study carried out for the creation of this greenway included climatic, geographical and geomorphologic analyses, as well as an assessment of the landscape, biodiversity, industry, and contamination levels. The results of the evaluation of these aspects identified: (1) valuable elements that should be part of the greenway, (2) measures to protect resources and decontaminate waters, and (3) course of action towards industrial activity. The results also revealed that all four cantons have a very low percentage of green areas [Table 1] (MSJ, 2004).

The inventory of flora and fauna carried out by the Fundación Defensores de la Naturaleza (FUNDENA) describes the deficient state of the river corridor. The study considered that near 80% of the river ecological systems are fragmented and negatively impacted by human activity, causing contamination of waters, solid waste accumulation, and reduction or complete extinction of the forest cover. However, the study confirmed that some parts of the corridor of the MAR are still rich in

<table>
<thead>
<tr>
<th>Level of green in each canton</th>
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<tbody>
<tr>
<td>Canton</td>
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<tr>
<td>Curridabat</td>
</tr>
<tr>
<td>La Unión</td>
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<tr>
<td>Montes de Oca</td>
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<tr>
<td>San José</td>
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</tbody>
</table>
vegetation and wildlife. It identified 383 species of plant life (trees, shrubs, fungi, and other small plants), and 157 species of animal life (insects, birds, reptiles, amphibians, and mammals). FUNDENA’s study segregated the river into three sectors [Fig. 6]. Sector I represents the densest segment of the river corridor in terms of biological features. Resources drastically decrease as the river enters the populated areas of the cantons (sectors II and III), being sector III the most affected one. However, the study considers that even sector III could recover from the damage if the proper measures are taken. It also encourages the preservation of the existent green cover and the reintroduction of native vegetation to maintain connectivity, avoiding fragmentation and biodiversity loss (Fallas, 2001).

One of the most worrisome issues is the untreated discharge of sewage into the river. This practice could obstruct the recovery efforts due to the large investments needed for changes in infrastructure and public roads. The physical obstructions along the river margins can prove extremely difficult to correct as well, due to time- and resource-consuming legal battles to relocate illegal riverside occupants, expropriation of adjacent land, and recovery of invaded public land (Fallas, 2001).

The canyon of the MAR together with urban parks and other green spaces represent the local natural heritage. The introduction of this greenway is seen as a possibility to improve the urban park system by revitalizing, protecting, and, when possible, connecting these important environmental assets. Besides its valuable natural resources, this corridor can provide a “clean” transportation option, recreation, and access to schools, parks, and historic and cultural heritage (MSJ, 2004).

**Objectives of the project** (MSJ, 2004):
- General objective: to incorporate nature into urban areas through the development of a greenway in the María Aguilar River to use it for alternative transportation and recreational purposes, increasing accessibility to parks, green areas and riparian zones.
- Specific objectives: (1) to promote recreation and leisure in river corridors through the development of cycle routes and pedestrian trails, (2) to assess the possibilities of using the right-of-way of the railway as an alternative transportation corridor by creating cycle routes and pedestrian trails, (3) to foster natural and biological continuity between urban and suburban green spaces through the reforestation of corridors [Fig. 6].

**Components of the project** (MSJ, 2004):
- First component: The development of a management plan for the protection of the three riverheads of the MAR to recover and decontaminate them through the construction of a treatment plant.
- Second component: The promotion, conservation, and recovery of the MAR, ensuring that it is officially declared as a “biological corridor,” allowing at the same time connectivity and protection of the natural patches to facilitate the movement of species, and social activities to improve the residents’ quality of life.
- Third component: The creation and integration of green spaces, recreation areas, parks and riversides to raise the environmental and recreational benefits of cities.

*Fig. 6. Map of the María Aguilar River (MAR) Greenway and Cycle Route Project*.  
*Source: Corredor Biológico Río María Aguilar Office*
Fourth component: The construction of the cycle route using the railroad right-of-way to link natural, cultural, historical sites, and other places of interest for the local communities and provide an alternative transportation route.

This project stresses the urgency to preserve the scarce green spaces available in these four cantons. Because of the many connections, functions, and benefits they provide, greenways should be considered as important as any other infrastructure of the city. It is for this reason that we believe this project requires to be managed from a holistic approach, managing all the elements as a whole in an endeavor to contribute towards the betterment of the cities involved. The MAR Greenway and Cycle Route Project represent a formal effort to reclaim nature and provide healthier cities for the people. Should this project be constructed, it would be the first urban greenway of the country. Its implementation represents a remarkable opportunity to promote greenways as a strategic planning solution that uses urban natural resources in a more responsible way.

4. Determining the most critical issues of the current urban model of the GAM

The GAM is the most significant urban development in the country. It consists of 31 cantons, holds 53% of the total population, 70% of the existent vehicle fleet and 83% of the industry (Martinez, 2007). This region has increased its size in 80% during the last 11 years (1967km², 3.8% of the national territory).

In recent years, Costa Rica has been one of the few countries in the world that has been able to raise its forest cover in an area equivalent to 10% (FAO, 2007). Measures to preserve rural land as national parks and protected areas have been embraced since the 70’s succeeding in the protection of almost a quarter of the national territory. However, nature conservation in urban areas has been neglected and except for the creation of a few new parks, attempts to increase green areas have been scarce.

At a glance, the metropolitan cantons seem to have grown spontaneously and disorderly, when actually the planning of this area has been done for more than fifty years. The problem has been the overwhelming violation of regulations. The urban sprawl of the GAM has ignored natural areas, losing green spaces valuable for recreation and human interaction. People have abandoned urban centers to live in walled housing complexes separated from the least fortunate inhabitants, who have been pushed to the least convenient and almost inhospitable places of the city (Mora, 2007).

According to Picado (2003) in the past twenty-five years, the growth of the city of San José has gone beyond the scope of coverage of basic public services and this situation has become a form of aggression to the environment. Problems such as (1) the rapid increase of demands for potable water that is in constant conflict with the production

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Table 2. Main cause of problems and the effects exerted over residents, environment, and development.

<table>
<thead>
<tr>
<th>Main Cause</th>
<th>Residents</th>
<th>Environment</th>
<th>Development</th>
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<tbody>
<tr>
<td>INSUFFICIENT &amp; INADEQUATE URBAN PLANNING</td>
<td>Reduction of recreational spaces</td>
<td>Deforestation and loss of green areas</td>
<td>Low density urban sprawl</td>
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<tr>
<td></td>
<td>Higher life costs for all citizens</td>
<td>Deficient management of sewage and solid waste</td>
<td>Increased costs of infrastructure</td>
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<tr>
<td></td>
<td>Cities not perceived as inclusive and pleasant places</td>
<td>Reduction of valuable local wildlife habitats</td>
<td>Public transportation not prioritized</td>
</tr>
<tr>
<td></td>
<td>Reduction of the opportunities of being in contact with nature</td>
<td>Fragmentation of the urban landscape due to spontaneous development</td>
<td>Development in lands with opposed uses</td>
</tr>
<tr>
<td></td>
<td>Risk of developing diseases due to contamination</td>
<td>Contamination of aquifers, soils, and rivers</td>
<td>Settlements with no basic facilities and health services</td>
</tr>
<tr>
<td></td>
<td>Increased perception of lack of safety</td>
<td>Lack of attention to improve and increase the inner city green spaces</td>
<td>Abandonment of city centers</td>
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<td></td>
<td>Feelings of alienation or lack of trust</td>
<td>Loss of natural resources that should have been under protection</td>
<td>Illegal occupation of hillsides and riversides</td>
</tr>
<tr>
<td></td>
<td>Increased commuting distances, wasting time and affecting personal economy</td>
<td>Excess of noise and air pollution</td>
<td>Insufficient roadway infrastructure and traffic congestion</td>
</tr>
</tbody>
</table>

Other problems that contribute to worsening the situation:

- Lack of citizen participation and involvement in the decision making process
- Lack of political will
- Lack of environmental education
- Lack of communication and coordination between municipalities
- Lack of resources and funding
capacity, (2) the absence of treatment of domestic and industrial waste, (3) the absence of a plan of road infrastructure, and (4) an outline of modern and efficient public transport have significantly affected the quality of life of citizens and the functioning of the city as a whole.

In the metropolitan cantons the major forested areas are under protection, the majority of these areas are located in the periphery of the GAM. According to a report provided by MIVAH et al. (2006) the protected forest areas showed a diminution of 14.5% in ten years while the non-protected forests showed a dramatic diminution of 31.5% in the same period of time. This is mainly because most non-protected areas are located inside the development zone where adequate planning strategies to preserve urban nature are extremely weak.

From a technical point of view, urban planning in the GAM has been insufficient to reach and control all areas and aspects of the city, and from a legal-institutional perspective, it has been ineffective in implementing and enforcing the necessary regulations. It is therefore that the insufficient and ineffective urban planning was identified as the main cause of problems in the GAM.

In the document review, a large body of research was examined to gather, compare, and define the most critical problems of the current urban model of the cantons that form the GAM. (e.g. Martínez, 2007; Mora, 2007; López, 2007; SICA et al., 2007; Brenes, 2006; MIVAH et al., 2006; Argüello, 2004; Klotchkov, 2004; Picado, 2003; Brenes et al., 2001; PEN, 2005; 2006; 2007 & 2008 are some of the contributions reviewed). A total of twenty-four issues and five other problems that contribute to aggravating the situation of the GAM are summarized in Table 2. For the purpose of this study, the issues were classified depending on which of the following aspects they mainly affect: RESIDENTS, ENVIRONMENT, and DEVELOPMENT.

5. Discussion and conclusion

This section aims to determine the positive influence of greenways over the most critical issues of the current urban model of the GAM. In the following discussion we suggest the expected effects of greenways over the GAM. The twenty-four issues derived from the insufficient and ineffective urban planning, and the most recognized functions of greenways were arranged into a contingency table [Table 3].

The table was framed as follows: The functions of greenways (explained on page 2) are characteristics recognized internationally and reported to be present in places where greenways have been developed. These functions were horizontally distributed in the table while the problems obtained in section 4 were distributed in the vertical axis. Each function was compared with each problem, classifying their relation as O = “problem expected to be positively influenced by this function” or x = “problem not expected to be influenced by this function”.

<table>
<thead>
<tr>
<th>Problems of the current urban model of the GAM</th>
<th>Most important functions of greenways</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main cause and effect over</td>
<td>Protecting nature and heritage</td>
</tr>
<tr>
<td>1. Reduction of recreational spaces</td>
<td>O</td>
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<tr>
<td>2. Higher life costs for all citizens</td>
<td>O</td>
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<tr>
<td>3. Urban areas not perceived as safe and pleasant places</td>
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<tr>
<td>4. Reduction of the opportunity of being in nature with others</td>
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<td>5. Risk of developing diseases due to contamination</td>
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<tr>
<td>6. Increased perception of lack of safety</td>
<td>X</td>
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<tr>
<td>8. Increased commuting distances, waiting time and affecting personal economy</td>
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<td>O</td>
</tr>
<tr>
<td>2. Deficient management of sewage and solid waste</td>
<td>X</td>
</tr>
<tr>
<td>3. Reduction of valuable local wildlife habitats</td>
<td>O</td>
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<tr>
<td>4. Fragmentation of the urban landscape</td>
<td>O</td>
</tr>
<tr>
<td>5. Contamination of rivers, soils, and waters</td>
<td>O</td>
</tr>
<tr>
<td>6. Lack of attention to improve and increase the inner city green spaces</td>
<td>O</td>
</tr>
<tr>
<td>7. Loss of natural resources that should have been protected</td>
<td>O</td>
</tr>
<tr>
<td>8. Excess of noise and air pollution</td>
<td>O</td>
</tr>
<tr>
<td>1. Low density urban spaces</td>
<td>O</td>
</tr>
<tr>
<td>2. Increased costs of infrastructure</td>
<td>X</td>
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<tr>
<td>3. Public transportation not prioritized</td>
<td>O</td>
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<tr>
<td>4. Development in land with exposed uses</td>
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<td>6. Attractiveness of city centers</td>
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<td>7. Urban occupation of hillsides and ravines</td>
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<td>8. Insufficient roadway infrastructure and traffic congestion</td>
<td>X</td>
</tr>
</tbody>
</table>

Table 3. Contingency table between the problems of the current urban model and the functions of greenways

The problem with the largest number of functions influencing it (horizontally) is 5. The most influential function (vertically) is O. Improvement possibility: O = It is expected that this issue could be positively influenced by this particular function. X = This issue is not expected to be influenced by this particular function.
The range of influence was not divided into different categories because the interest of this study is to present if certain problem has a possibility to improve with the existence of greenways, and not to what extent. The classification (✓ or ✗) was based on data obtained from previous research and governmental statements, where it was reported that greenways have had a positive impact over similar problems. It was therefore suggested that the same problem could improve under the influence of the same function but in the Costa Rican context.

In general terms, nature and heritage protection is considered to be one of the most important functions of greenways. However, in the results obtained from table 3, this function rated number two while the function considered the most influential for the urban problematic of the metropolitan cantons was ‘shaping community growth’. It is believed that this attribute of greenways can provide significant changes in the GAM, especially to plan and design urban growth patterns, separate opposed land uses, prevent spontaneous development, establish conservation areas and link open spaces and other areas of interest for the community.

In the first component, RESIDENTS, the problem ‘cities not perceived as inclusive and pleasant places’ was identified as the issue that could perceive the most greenway benefits [Table 3]. Greenways have the capacity to provide people with new and diverse opportunities for recreation, cultural activities, fitness, transportation, and even education. They can help people perceive the city as a more agreeable space, where nature and development can coexist. People can also benefit from a city that provides spaces to be in contact with nature. As recognized by Bishop et al. (1991), urban nature has an important role as an element that could help residents and visitors momentarily escape from the busy city, providing a place to rest and relax. Residents can benefit from using greenways as an alternative transportation route, especially at local level. People can reduce transportation costs at the same time they exercise and contribute to a cleaner environment. An important example in this field is the city of Bogotá (Colombia), which in only three years (1998–2001), was transformed into a pedestrian-friendly city increasing 900% the bicycle use in four years. This transportation option is seen in Bogotá as a great change for the city, but mostly a significant change in people’s mind.

In the second component, ENVIRONMENT, the problem that resulted as the most favored by the benefits of greenways was ‘deforestation and loss of green areas’ [Table 3]. The outdated and therefore inadequate planning methods, as well as the weak urban environmental policies and legislation of the GAM have left this region with scarce green spaces. The reforestation, promotion, and protection of corridors and public spaces in the urban context can help regenerate native vegetation and wildlife habitat.

By putting together design and ecology, greenways can make cities more livable by providing connections between people and nature, and fostering the development of new green areas (Pellegrino, 1987; Ma mediated-Frischenbruder & Pellegrino, 2006). The designation of river corridors as preservation areas will guarantee their protection through stronger regulations, enhancing at the same time the conditions of the natural elements forming the corridor. As recognized by Markeson (2007), when strategically utilized, greenways can absorb noise and pollution acting as buffers between incompatible land uses.

In the last component, DEVELOPMENT, ‘abandonment of city centers’ was the issue expected to benefit the most from the existence of greenways [Table 3]. This particular problem has already resulted in decay and emptiness, leading also to urban sprawl and loss of inner and peripheral natural areas. It is believed that greenways can contribute in the revitalization process of city centers. According to the RISPP (1994) river greenway projects are becoming an important asset for conserving and revitalizing urban neighborhoods, and city centers through which the rivers flow.

Other ways in which city centers and communities in general can improve their image and attract people are by designating river corridors as protection areas to stop Riverside illegal occupation, improving its visual and environmental quality. Greenways can increase property values, commerce opportunities, and tourism, directly contributing towards socio-economic development. This sense of general well being related to greenways can increase awareness of the importance of preserving green spaces. Neglected green spaces (e.g. river corridors) can become attractive and useful, and thus, add to the economic growth of a downtown, improving their image and being perceived as more pleasant and convenient spaces to visit, work, and live.

Even though the idea of having an urban greenway system can be attractive and even welcomed in the GAM, some problems identified in this study may seriously and negatively affect the possibilities for implementation: (1) lack of public participation, (2) lack of environmental education, and (3) lack of resources and funding. Plan PRUGAM introduced a more participative approach that included public involvement in the planning process, proposals for environmental campaigns, and international funding. However, these conditions are particular of Plan PRUGAM, and although a greenway project inside the GAM could benefit from the achievements of this plan, it will require great organizational efforts of the local government(s) to integrate all the necessary elements for its development.

Many authors (e.g. Luymes and Tamminga, 1995; Aycart-Luengo, 2001; Yokohari et al., 2004; Ryan et al., 2006) agree that greenway projects that include public involvement and support of the community have considerably more chances of being implemented than those that do not. In this sense, through public involvement in the greenway planning process, people will be able to learn about greenways, use them,
and perceive their many benefits. The involvement of citizens in the design and creation of public open spaces can make them feel proud of their city. If people are included in the decision-making process, they will feel safe in the streets. People feel enthusiastic because they are taken into account and perceive true progress (Rogers and Power, 2000).

Two other problems that may also affect the creation of a greenway project are: (4) lack of political will, and (5) lack of communication and collaboration between municipalities. One clear example of lack of political will is what happened after the completion of Plan PRUGAM. This plan was finished and submitted in December 2008; however, by May 2009 the plan was still waiting for approval from the board of directors of INVU, who stated that it would take three or four more months for them to adopt a resolution towards the plan (La Nación, 2009). The complex political-administrative framework and the heterogeneity of the challenges present in the GAM have prevented institutions from integrating and working for common goals, causing many regional problems due to lack of cooperation and communication between them.

According to Mora-Protti (2001), if an urban project is not completed within the same presidential term, the opportunities of fully developing and implementing the plan are reduced, mainly because the new municipal councils are usually not interested in the previous work and many of the projects are left aside. Mora-Protti (2001) also explains that one of the biggest obstacles between the government and the people is the idiosyncrasy of the Costa Ricans. According to him, people do not respond to the continuous calls for public hearings. This lack of participation is reflected in the plans that only include the points of view of professionals, and the results are seen as impositions from the government.

In summary, the proposal developed for the MAR Greenway and Cycle Route Project emphasized the need of the four cantons to increase their amount of green areas, protect the natural resources, diversify recreation, and provide connections. This project represents a segment of what could be a future comprehensive network of greenways that can help guide development, regenerate nature, and provide more livable places.

The metropolitan cantons are afflicted with a wide range of problems, many of them result from the insufficient and ineffective urban planning model of the region. After juxtaposing the functions of greenways and the urban problems identified in this study, it was discernible that greenways could have a positive impact over the metropolitan cantons. Greenways represent a key planning strategy to achieve a change towards greener, healthier, and more humane communities.

Despite all obstacles that a greenway project will have to confront, its creation can be achievable in theory. To become achievable in practice it is essential to create a coalition where all stakeholders (e.g. public and private sectors, NGOs, residents) can participate, communicate, and collaborate to envision local and even regional networks of greenways that can help direct the relation: nature-development towards an equitable alliance for the benefit of the residents and the future generations.

Despite the multiple benefits greenways have provided in urban areas around the world, we cannot pretend to integrate a foreign planning model into the GAM just because it has worked for other cities. We need to find our own interpretation of the greenway concept to achieve positive results. The ‘Costa Rican’ interpretation should reflect the culture and traditions of the nation. Cities in the GAM should truly project the standards that have given international renown to the country such as: peace and nature. Conservation of natural resources should not be pursued only in rural areas; on the contrary, the conservation efforts of rural areas should also be put into practice in the urban setting.

We consider that further research is needed to understand how residents of these areas perceive greenways. It is necessary to carry out a comprehensive analysis of preferences and perceptions that could help urban designers and planners envision better landscapes for better cities.

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(Received 2 Sep. 2009; Acceptable 4 Jan. 2010)
コスタリカ、サンホセ市の都市環境再生におけるグリーンウェイの役割

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グリーンウェイとは、河川、運河、歴史的路路、緑地などといった直線的な要素に沿って整備した自動車道ではない道路であり、レクリエーション、交通、保全などの様々な目的を有するものである。グリーンウェイは住民のための利用空間を与えるとともに、自然や景観を保全するための有効なプランニングのツールとなっている。

本研究ではグリーンウェイとそれのもたらす利点が、環境問題だけでなく、都市問題をも緩和するという前提にたって、市レベルにおける河川沿いのグリーンウェイおよびサイクリングロードに関する計画を紹介する。このプロジェクトはレクリエーションや保全を目的とした緑地を増加させるための重要な役割を演じるであろう。また、本研究では大都市圏に不健全さをもたらす要因、およびそれが住民・環境・都市の発展にもたらす負の効果も明らかにした。

本研究の結果から、現代の大都市地域モデルの様々な問題は、グリーンウェイの効果によって改善されることが示された。また、グリーンウェイを都市の自然を再生する効果的なアプローチとするためには、そのコンセプトを正確に解釈し、適用する都市の特性や必要性に適応させることが必要であると考えられる。