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The Vegetal Corridor as a Landscape and Environmental Tool for Biodiversity Conservation: The Case of the Cali River in Colombia

Concern for the environment has become a priority concern worldwide. Since its origin, landscape ecology has been linked to the problems of territorial planning and management. This paper aims to delve deeper into the concept of environmental corridor: in its conception, definition and evolution, focusing on a series of ideas that affect both its application on territorial and urban planning, its own morpho-typological configuration, and its application within architecture and urban planning.
Methodologically, the article theoretically analyzes the idea of "corridor" from the principles of ecology and sustainability following the main existing bibliographical references, exposing different proposals for corridors and environmental networks, and verifying these principles on a particular recent example of a green corridor: that of the Cali River in Colombia, which is manifested as an urban example of natural connectivity and where conservation strategies and sustainable use of biodiversity are addressed in a transformed landscape.

Keywords:
Cali River; green corridor; biodiversity; sustainable urban design; landscape ecology

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INTRODUCTION

Man's relationship with the Earth has always been exclusively economic, imposing only privileges, never obligations. As P. Marsh already warned in a pioneering way at the end of the 19th century, "man's actions, apparently insignificant, are cumulative and generate, over time, profound and harmful changes in natural systems" [1861, p.56]. More than a century after the emergence of these first concepts of environmental ethics, the questions currently posed to the scientific community concern the survival of rural and agricultural spaces: nature reserves, national parks, land concentrations, river banks, etc.; or to improve the eco-livability of urban spaces: green corridors. Nature protection laws and environmental impact studies prior to carrying out important works have favoured the development of evaluation methods derived from the transformations of the landscape structure and their consequences on ecological processes. The central position occupied by the space of landscape ecology makes it a privileged field for the definition of the principles of territorial planning, highlighting the importance of green spatial structures in particular phenomena and processes, such as animal movements, the recovery of forest species or the circulation of water in rivers and streams. This last element being crucial since the watercourse is "the linear element that has the greatest potential capacity to host and move life" [Jiménez, 2013, p.75].

On the other hand, landscapes are dynamic and not necessarily aligned with the development of ecological processes. The various elements and structures discernible in a landscape depend closely on processes of organization and evolution that are not necessarily spatial. In the planning process, whether at a territorial or urban scale, antagonistic or collaborating social groups are present, making it necessary to consider a comprehensive economic and cultural dimension of the matter. In this way, and depending on the objectives to be set for a particular territory or space, certain doubts may always arise when faced with a future action: What elements should be maintained, introduced or modified in a landscape? What shape and surfaces to give them? How to organize them with each other? O what consequences can these actions trigger on the functions of the landscape?

THE CORRIDOR CONCEPT IN TERRITORIAL PLANNING

McHarg said that "of all the instruments available to man for successful adaptation, cultural adaptation in general and planning in particular, appear to be the most direct and efficient for maintaining and increasing man's health and well-being" [1981, p.109]. The concept of "corridor", as a means of circulation for dispersing individuals, has been quickly used by environmental technicians in planning, who have seen it as an economic means in space, useful to alleviate the negative effects of environmental fragmentation. Its creation is integrated into a renewed approach to conservation science.
The concept of "green corridor" or "greenway" [1] emerged in the 1950s, although it has been implemented for more than a century [Litle, 1990]; Its creation for wildlife protection dates back to the beginning of the 20th century, both in the United States and Great Britain. Already in 1860, Frederick Law Olmsted highlighted the benefit of linear open spaces, applying this idea to the planning of cities such as Berkeley, New York, Chicago, Buffalo or Boston. In England, the concept of the "garden city" was developed at the end of the 19th century. The idea was based on circumventing the city center with a green belt about 100 meters wide; beyond the industrial zones, the city should be surrounded by farms and forests. Following this dynamic, numerous cities in Great Britain were adapted [Smith, 1993]. Quickly, this way of understanding the green corridor was transplanted to ecological development, mainly in mountain areas.
Generally, the concept refers to a strip of vegetation that connects fragmented natural areas or dispersed habitats. This linear structure of vegetation can encompass a wide variety of landscapes, from forests and jungles to grasslands and wetlands, and can have different dimensions and configurations depending on the environment in which it is located: a river, valley, ridgeline, scenic route or a natural or historical heritage area.
Green corridors are created for different purposes, depending on the character of their designer: an environmentalist technician will implement them for landscape aesthetics or for the enjoyment of leisure; On the contrary, a conservation ecologist will carry them out to conserve or restore the ecological integrity of a natural area, following the purpose of facilitating the mobility of plant and animal species between different habitat patches –reserves–; the latter promotes biological diversity and contributes to the conservation of biodiversity in landscapes fragmented or disturbed by human activities; They can be used as tools for ecological restoration, mitigation of conflicts between wildlife and human activities, and adaptation to climate change. Although the objectives are different, they will not be exclusive, and several can be combined.
Already before 1950, animal protectors advocated the effectiveness of linear elements such as hedgerows or riparian forests [Harris & Scheck, 1991]. The extension of protection to larger species highlighted the importance of creating the corridor network. These "greenways" were taken up by other countries, such as France, where they were incorporated into the urbanization schemes of large cities in the 1960s. In the 1960s, river pollution problems led to the creation of numerous greenways in riparian zones, as grassy strips along rivers.
The recognition of the instability of populations, whether animal or plant –including humans– led to the evolution of concepts related to the protection of nature and, more recently, to the maintenance of its biodiversity. Territorial planning technicians refer to the notions of central zone, buffer zone and corridor. But the creation of reserves and even the generation of well-defined territories is not enough to address the maintenance of populations. The question of scale is also decisive in the evaluation of the role played by the corridor in maintaining biodiversity. Thus, for example, a hedge in a "*bocage*" landscape and the Isthmus of Panama function

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very differently. Corridors ensure multiple functions to the landscape, although there are no systematic empirical studies that evaluate their effects on biodiversity as a whole [2]. When implementing a corridor, the global functioning of the landscape must be kept in mind, although most of the time these structures are designed and intended for the particular conservation of a specific species [Diamond, 1976; Soulé & Gilpin, 1991]. According to Lindemayer and Nix [1993], in its formation it is necessary to take into account the interrelation between four factors: the spatial structure of the landscape –position in the landscape, the isolation of the reserve spots and their functional connectivity, the edge effect and the nature of the circulating matrix; the dimensions of the spots and corridors –in terms of surface and shape–; the quality of the habitat –flora, structure, age, type of habitat and the availability of limiting resources–; and the autoecology and demography of the species –their vital characteristics, behaviour and population dynamics–.
The reserves, which are nothing more than eco-structural areas or spots, must allow the protection and management of natural or semi-natural landscapes representative of the territories and their regions. The design of reserves is a fundamental tool to maintain or strengthen ecological functioning, heterogeneity, fragmentation and, ultimately, biodiversity. To do this, they must be reasoned and anaged in terms of networks [3]. Species, populations, habitats, which traditionally constituted sole objectives in protected areas, are now considered components of open, dynamic or heterogeneous ecological systems. For its conservation, the study of its perfect functioning in terms of its –ecological– processes, the migration of living beings and the structure of its communities and its relationship with neighbouring communities –whether they are humanized or not– must be taken into account within a particular and concrete landscape context.

THE CONFIGURATION OF THE CORRIDORS: FORM AND TYPE

There is no universal definition for the term "runner." Its shape, type and maintenance are relative and depend on the space considered and the environmental state; There are no general rules but rather particular cases. The quality of the habitat inside a corridor is decisive for the landscape. In the case of forest species, the complexity of the vegetation structure will determine its survival capacity at the local level. The width of the corridors is considered a fundamental variable –although there is still little empirical data that confirms this hypothesis– and can theoretically establish that wide corridors favour the movement of species from the interior environment" [Burel & Baudry, 2002, p.291]. Now, to the question posed of what width is most suitable for a runner? Most scientists respond that "the wider it is, the better it will work" [Noss, 1987, p.162].
In 1995, R.T. Forman proposed an evaluation of the effectiveness of corridors based on their quality and width. Thus, a corridor that connects two patches and is bordered by medium to high quality habitats will promote a higher rate of movement between patches [figure 1]. The decrease in the connectivity of the corridor and its quality, as well as that of neighbouring habitats, would reduce the intensity of migrant flows. The presence of barriers or hostile environments between spots is also a limiting factor in the movement of individuals. For example, many arboreal mammals require a continuous line of trees to disperse from one forest to another [Dmowski & Koziakiewicz, 1990]. The straight shape of the corridor, more or less tortuous, also intervenes in determining the flow of organisms. Soulé and Gilpin hypothesized that rectilinear corridors are more effective than curved ones, "because the animals do not have to search or modify their direction" [1991, p.4], and particularly beneficial for the youngest ones who do not yet know the path. As for width, its dimension must be adapted to the particular characteristics of the species on the move: a corridor for elephants, for example, should not be less than five kilometres wide –migration path–; and not going below 500 meters for other minor species, such as antelopes. The possibility of fires must also be anticipated and controlled, and the reduction of traffic on the roads that cross these corridors must be studied [4].
It has been more than forty years [5] since national parks are no longer considered isolated areas, but rather as a continuous set of protected areas. As an example of faunal corridors, the one of the Río Grande [6], in the south of the USA, is

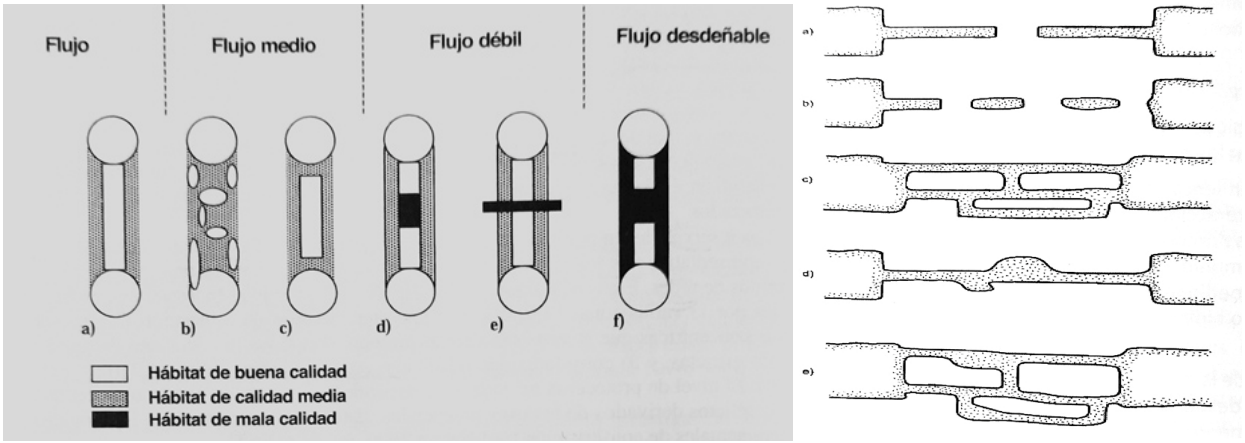

Fig. 1. Left: Intensity of the migratory flow of the corridor between two spots as a function of connectivity and environmental quality, according to Forman [1995]. Right: Influence factors on the structural connectivity of the corridor: (a and b) number and length of gaps (c) existence of a road network (d) presence of habitat nodes associated with (e); according to Bennett [2003].

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worth highlighting, which links a dozen reserves, with a total length of 750 km. and an average width of 10 km.; the Pinhook Swamp corridors –30,000 ha–, the Suwannee River and the Wekiva in Florida [7]; or the international corridor between Italy and Switzerland [8].

THE ECONET NETWORK OF EUROPEAN BROKERS

The global decline in biodiversity associated with the relatively recent deterioration of landscapes is a confirmed reality. The decrease in the areas of natural or semi-natural habitats, as well as the fragmentation of important areas into increasingly isolated islets, are responsible for this situation. The area occupied by wetlands has decreased by more than half in most countries in the last 50 years; The Mediterranean forest does not cover more than 10% of the original surface; coastal and alpine areas are threatened; Intensive agriculture has reduced grasslands, heaths and forest areas throughout Europe, according to Burel and Baudry [2002, p.292]. In these circumstances, Europe has developed a strategy based on the biogeographic theory of "islands" and the functioning of populations and the spatio-temporal organization of landscapes in relation to human activity, to define an "ecological network" at the global level continental whose objective is to offer biological populations the structures necessary for their survival in landscapes of intense human exploitation. To achieve this, we had the support of multiple official organizations and some specific initiatives were launched. In Europe, the project to create a continental ecological network –ECONET– already dates back to 1991 [9]. Also that same year, Bischoff and Jongman proposed the "Tentative Ecological Main Structure" plan [1991] which sought the maintenance of central areas, such as large protected reserves –national parks, landscape areas or areas of special natural interest– and the creation of other areas for connection [figure 2]. These connections would be defined based on the ecological characteristics of the reserves that they should connect. Mostly, they would rely on the main migratory routes of birds and mammals in Europe; In later phases they would be defined at the regional or local level. In 1995, the European states decided to include this project in a more ambitious pan-European strategy, relying on an important series of international devices [10] and determining a series of objectives that, according to Nowicki [1996], within a period of 20 years, would reduce threats to landscapes and their biodiversity, reinforcing their ecological coherence and facilitating the conservation of ecosystems and threatened species. As an example of a national network, the Parliament of the Netherlands approved the *Nature Policy Plan* in 1990, whose objective was to try to recover the natural wealth lost over the last century: since 1900, the surface of natural areas had decreased by 75%, with the remaining areas being small and highly fragmented; the fauna [11] and the flora gradually decreased in number of species. To alleviate the catastrophe, a network of ecological corridors was established to be developed over the following three decades. As in the ECONET network, this plan generated, in addition to the corridors, a set of central areas –500 hectares– and others of less intense natural development –humid meadows and marsh areas–. The corridors, which could be natural or artificial, facilitated migrations; they were made up of: hedges, dikes, canals, paths or the edges of streams. The Plan became a political challenge: due to its coherence and attractive presentation, it turned out to be a stimulating and unifying proposal, both for authorities, politicians and the general public.

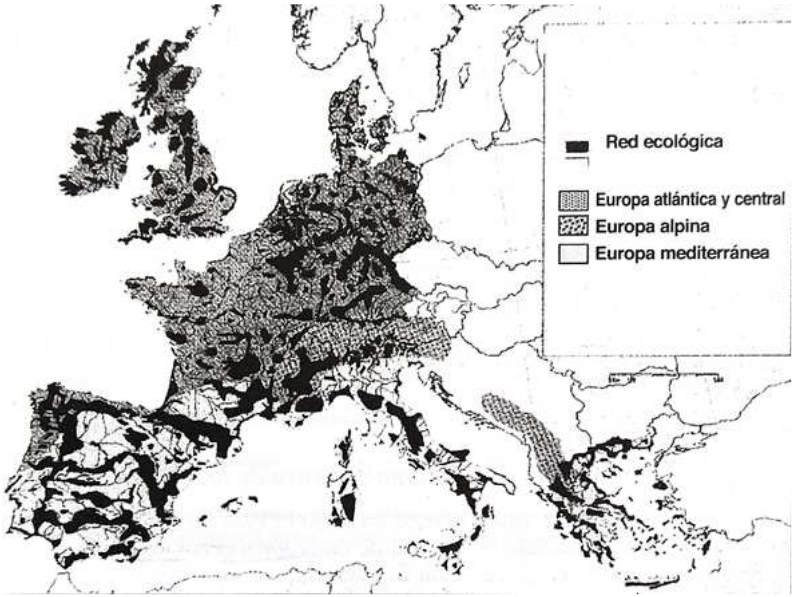

Fig. 2. Map of the "Tentative Ecological Main Structure in the European Community" strategy, according to Bischoff and Jongman [1991].

DOI: https://doi.org/10.20365/disegnarecon.33.2024.13

ISSN 1828-5961

CORRIDORS IN ARCHITECTURE: BEYOND THE ECOLOGICAL FUNCTION

In the field of architecture, green corridors can have various applications that go beyond a purely ecological function, being more linked to social development and recreational activities. These can overlap one or several intervention systems such as: green infrastructure, the rehabilitation of degraded spaces, water management, the promotion of biodiversity in built environments and sustainable urban design.
Thus, green corridors can be designed as key components of the green infrastructure of a city or community, including linear parks, tree-lined boulevards, nature trails and other structures that allow the flow of biodiversity through the urban environment. In degraded or abandoned urban areas, they can play a fundamental role in the rehabilitation and revitalization of the environment and its marginal spaces; by converting vacant land or industrial areas into corridors, the environmental quality and aesthetics of the site can be improved, as well as providing social and recreational benefits to the community.
Green corridors may also have applications in urban water management; For example, they can be designed to capture and filter stormwater, helping to prevent flooding and improve water quality in urban rivers and streams. They can provide habitats and shelter for urban fauna, including birds, insects and small mammals; by integrating elements of native vegetation and shelter structures into the design of urban green corridors, biological diversity can be promoted in built environments. They can be integrated into urban design as part of sustainable development strategies; this involves incorporating greenery strips into urban areas to promote ecological connectivity, improve air quality, reduce the urban heat island effect, and provide green spaces for recreation.

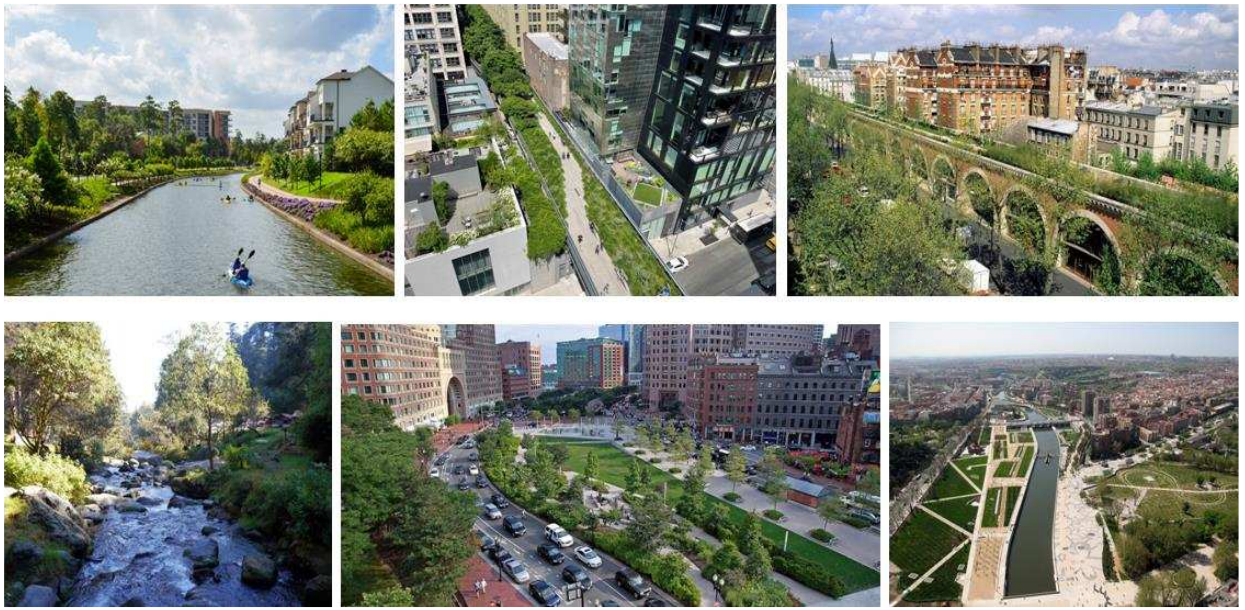

Fig. 3. Green corridors in architecture (from left to right and from top to bottom): city of Woodlands –Texas–, the High Line –New York–, Promenade Plantée –Paris–, Rose F. Kennedy –Boston –, Magdalena River –Mexico City– and the Manzanares River River Park –Madrid–.

As an example, we could use a boulevard or main avenue in a city that has been designed with a large central space divided by a strip of vegetation. This green space could include trees, shrubs, grass and native plants, forming something similar to a green strip that runs through the city. Along this corridor, there could be pedestrian and cycle paths, rest benches, children's play areas and rest areas. This corridor would not only provide a more pleasant and aesthetic environment amidst the urban environment, but also promotes biodiversity, helps reduce air and noise pollution, and provides opportunities for outdoor recreation and recreation for residents. local. We could cite outstanding examples that implement the use of green corridors in the practice of sustainable urban design. All of them have been effectively integrated into urban design to improve the quality of life of residents by promoting environmental sustainability [figure 3].
Firstly, at the beginning of the seventies, it is worth highlighting the design of the city of Woodlands in Texas, north of Hudson, whose objective was to create an urban space that would facilitate the lives of its inhabitants following ecological sustainability and fully respecting its natural environment. An ecological plan was

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proposed whose crucial point was the rehabilitation of riverbank corridors and the protection of streams, preserving natural open areas for recreation; thus, inhabited areas and roads would be concentrated on the worst-drained soils, directing the runoff waters naturally towards the most permeable soils. Also notable at an urban level is the Promenade Plantée in Paris, a linear park built on an old high-rise railway line. This pioneering project was completed in the 1990s and has inspired numerous similar projects around the world. The Promenade features raised gardens, pedestrian walkways, seating areas and carefully designed landscaping offering a green oasis in the middle of the city. Similar to the Parisian Promenade, New York's High Line is distinguished as a suspended linear park built on a former elevated railroad track on Manhattan's Lower West Side. This project transformed an abandoned railway infrastructure into an urban green corridor approximately 2.3 kilometres long. It features a variety of native plants, seating areas, public art and panoramic views of the city. The High Line has become an icon of sustainability and urban revitalization.
Another linear example would be the Renato Leduc Park in Mexico City, which is located in the heart of the megacity and follows the course of the Magdalena River; was designed to reclaim and rehabilitate a degraded public space and turn it into a green corridor accessible to local residents. The park has green areas, paths for walking and cycling, and recreational areas for the community. Or the Manzanares River River Park in Madrid, designed to revitalize and restore the urban banks of the Manzanares, transforming them into an urban green corridor approximately 10 kilometres long. The river park includes walking and cycling trails, recreation areas, children's play areas and natural spaces that promote biodiversity in the heart of the city.

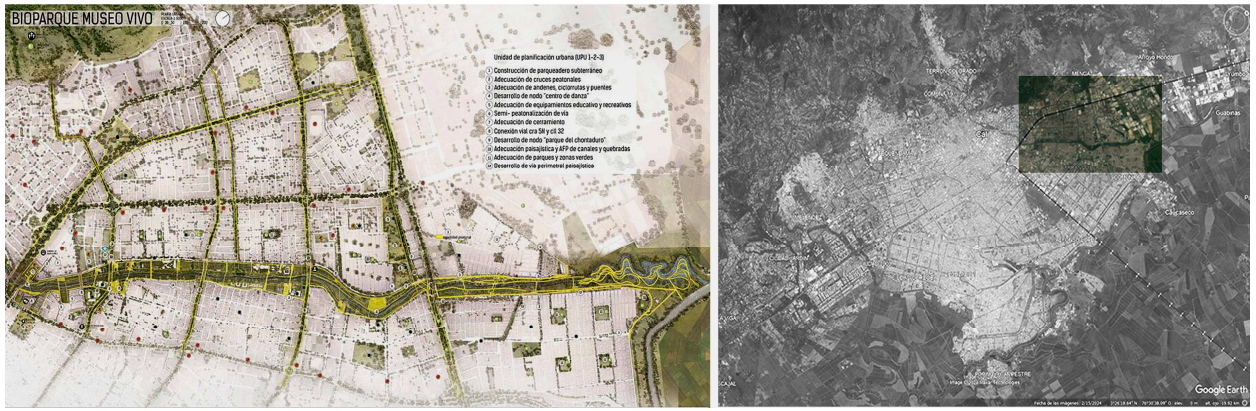

Fig. 4. Left: Joint plan of the project for the Environmental-Urban Corridor of the Cali River in Colombia. Alcuadrado Architects. Right: Urban location of the corridor over the city of Cali [Google Earth].

A PARTICULAR CASE: THE ENVIRONMENTAL-URBAN CORRIDOR OF THE CALI RIVER

As a recent case of implementation of an urban green corridor, it is worth mentioning the winning project of the competition for an environmental corridor in the city of Cali, Colombia; carried out by Alcuadrado Arquitectos + Habitar Colectivo [12], in 2018 [figure 4]. Since its beginnings, the project emerges as an environmental restructuring response to a river environment, intervening in the urban landscape to improve its ecological connections; taking into account that, as Rivas, San Martín and Steiner express in the introduction to *Designing with Nature*, "the suitability of a medium for a system is defined as that which requires the minimum adaptation work" [McHarg, 1969, p.7]. Thus, the Cali River project is understood as a large park articulated with the other natural spaces of the city: a continuous green axis, linear in nature; about eight kilometres in length and a width that ranges between 100 and 150 meters, which will improve its natural connectivity and emphasize the native natural character.
The objective of the call was to investigate how to integrate the city with its river, seeking a sustainable articulation between the main ecological structure and the complementary one, through the annexation of the pre-existing urban areas in a green belt that crosses the river environment [figure 5], complementing them with other spaces for all types of physical and cultural activities; thus integrating the anthropic with the natural. To this end, strategies for the conservation and sustainable use of the biodiversity of this transformed landscape were addressed, delving into the primitive native space –warm dry forest at the foot of the alluvial mountain–, which runs from the Farallones National Park to the Cauca River.

DOI: https://doi.org/10.20365/disegnarecon.33.2024.13



Fig. 5, fig. 6 and fig. 7. Aerial perspectives of the project for the Urban Environmental Corridor of the Cali River, Colombia, Alcuadrado Architects.

Understanding the environmental corridor as a continuous axis, it is proposed to implement new systems at road intersections to guarantee natural connectivity –through specific vegetation– in each section of the environmental corridor. The plan also contains a rich proposal of activities related to the recovery of the endemic fauna and flora of the Cauca Valley [figure 6].
As can be seen in the images [figure 7], the strategy at the communication level –pedestrian traffic system– seeks continuous integration and permeability between the river and the city, through the creation of mixed spaces that serve as connections – space-meeting–: small squares, avenues or urban gates become linear parks, interconnectors and green corridors. Each space will be accompanied by information points and multipurpose spaces. This encourages the use and enjoyment of nature and recreation. We must not forget that the urban environment must be designed, among other issues, to "conserve environment and leisure" [Vergara & Rivas, 2004, p.238].

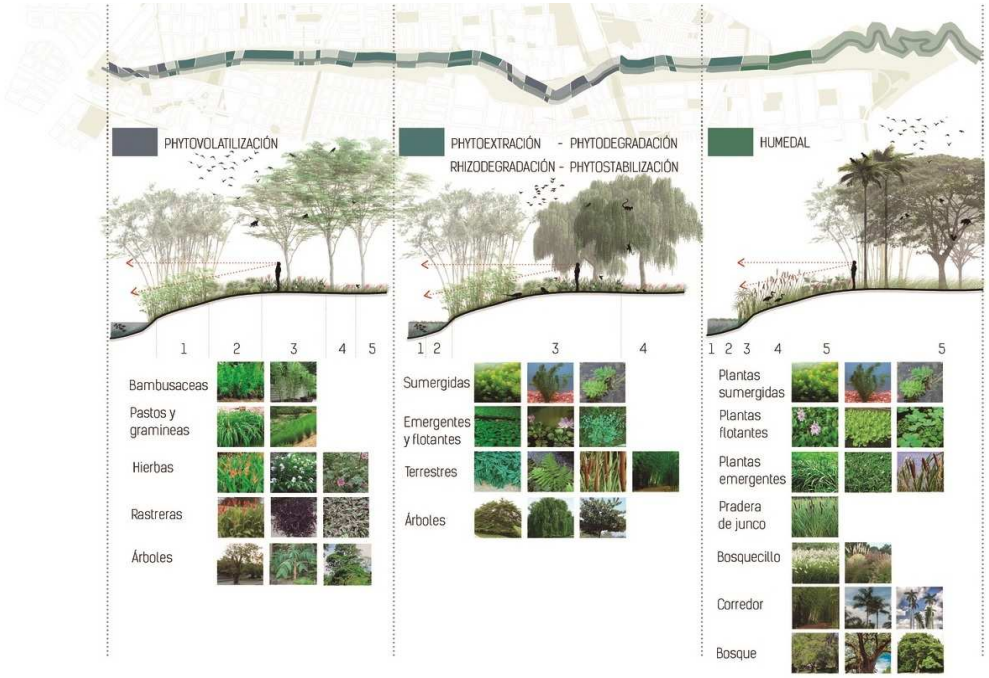

Fig. 8. Systems for water recovery. Project for the urban environ mental corridor of the Cali River, Colomvia. Alcuadrado Architects.

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ISSN 1828-5961

The project also proposes a series of intervention strategies that, autonomously and introducing natural processes in planning, provide an integrated response to the seven established objectives [13] that are superimposed on the corridor; These, in turn, establish a series of interrelationships among themselves. This creates a univocal and versatile response that completes all programmatic needs.
The proposed water recovery system is notable [figure 8]. As an example of sustainability, the proposal has a landscape impact on the formalization of the image of the wetland park, a scenario that allows, in addition to the enjoyment of its contemplation, to enhance the cleaning and treatment capacity of the river waters in the most natural way possible, proposing a recycling system for these waters from treatment plants following a process of purification, filtration and aeration; choice based on the behaviour of the channel and verified technical studies; All of this will also improve the wet berm and flood control. With this strategy you also achieve a space for contemplation, an environment of quality and attraction.

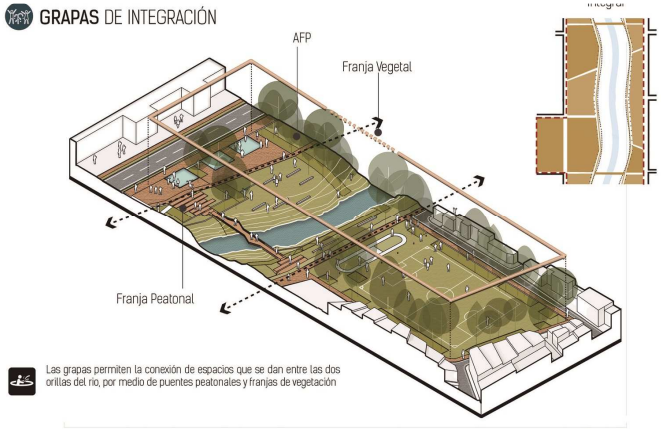

Fig. 10. Diagram of the integration clips. Project for the urban environmental corridor of the Cali River, Colombia. Alcuadrado Architects.

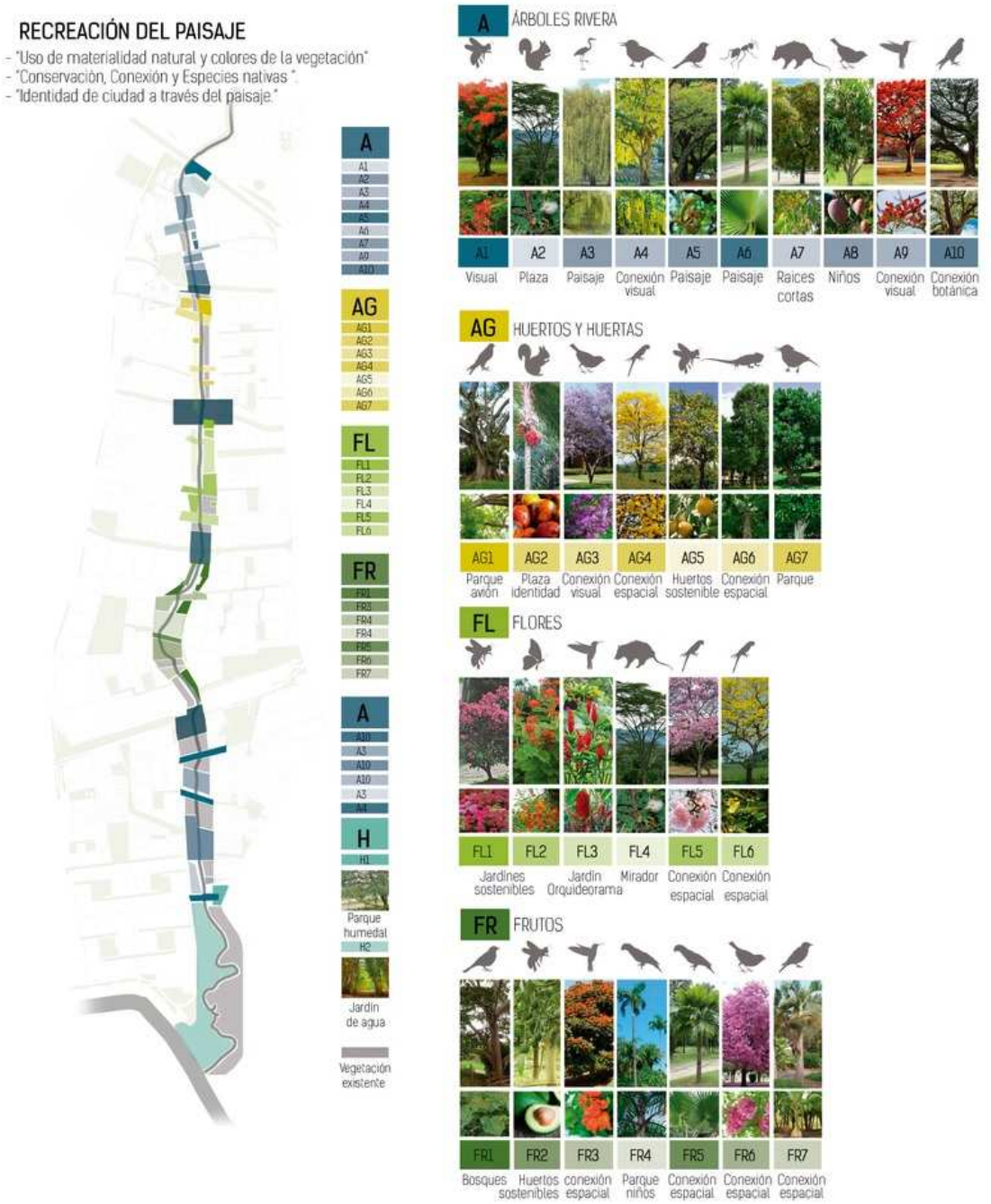

Fig. 9. Recreation of the landscape. Project for the urban environmental corridor of the Cali River, Colombia. Alcuadrado Architects.

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ISSN 1828-5961

Another overlapping intervention would be the recovery of the Protective Forest Area [figure 9] consisting of the incorporation of new species that delimit natural settings and improve the landscape. The tree mass is an essential element that makes up the plant body of the environmental corridor but also performs a function of improving the plant cover. The landscape is also used here "as an interpretive key and argument or guiding thread of spatial organization" [Santos & Rivas, 2013, p. 115].
As for McHarg "the interaction between natural and cultural systems belongs to the dynamics of living ecosystems and ultimately affects behaviour, health and general well-being" [1981, p.115], in the Cali corridor, the main element of social integration will be the "grapa" [figure 10], which will tie the two banks, creating new spaces –ecological and anthropic– that the community will appropriate to foster a new natural and social bond in these sectors degraded of the city.
The staples will delimit the different forest areas –AFP–, with new plant species, which will be particularized and will have their own landscape personality, determining varied points of view of the different scenes between the river and the nearby mountain range; in addition to creating small ecosystems that will revitalize the small endemic fauna and flora. As a form of control, trails will be implemented –inside the corridor– and viewpoints along the road that, in addition to their visual-landscape function between both banks –micro gardens– and connective, will prevent the expansion of illegal settlements in the most marginal areas of the strip. In this way, a double façade to the corridor is achieved, from the street and from the river, allowing a visual relationship between both sides of the river.
Also noteworthy is the creation of a living museum or "BioParque" [figure 11] that conceives different scenarios –identified with the museum stations– at different distances during five sections along the corridor, containing small forests, wetlands, orchards, germplasm, gardens, butterfly gardens, apiaries, botanical exhibitions of native species, fruit trees, local crops, bird watching, insects and regional fauna. The aim is to promote tourism with the creation of a mixed-use space where native artisans of the city and artists will naturally display the idiosyncrasy and culture of the valley. This way of showing nature contributes to interactively intensifying the experience of the green circuit and making it more pedagogical for the visitor through a narrative whose common thread will be interactive water accompanied by the richness and variety of agroforestry, which will follow a path towards contemplative water; a new dynamic relationship of creation of new ecologies –or ecological approaches– in time and space [14].

Fig. 11. "BioParque" scenarios. Project for the urban environmental corridor of the Cali River, Colombia. Alcuadrado Architects.

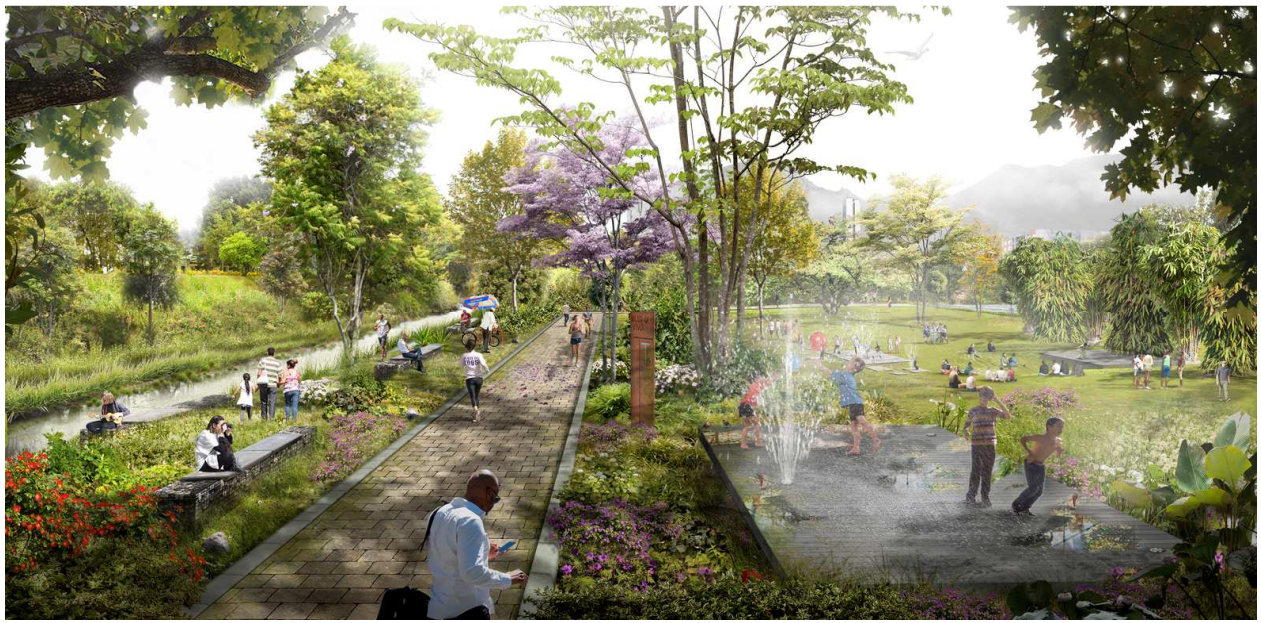

Fig. 12. Spaces for recreational activities. Project for the urban environmental corridor of the Cali River, Colombia. Alcuadrado Architects.

DOI: https://doi.org/10.20365/disegnarecon.33.2024.13

Fig. 13. Generation of ecosystems. Project for the urban environmental corridor of the Cali River, Colombia. Alcuadrado Architects.

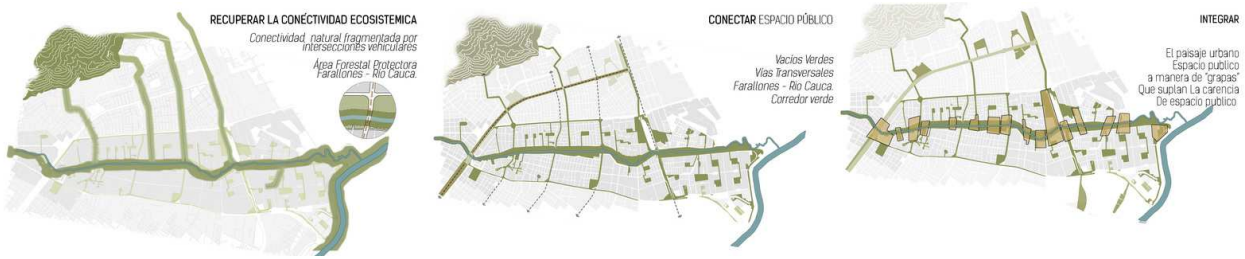

Fig. 14. Connectivity. Project for the urban environmental corridor of the Cali River, Colombia. Alcuadrado Architects.

Sensitive to pre-existing conditions, the intervention includes the rehabilitation of spaces intended for recreational, sports and educational activities [figure 12]. By integrating these spaces throughout the park, the aim is to improve and enhance them, thus achieving more efficient use.
As a large articulated park, forming a series of small ecosystems in each of the sections of the corridor [figure 13], the recovery of the city's endemic fauna and flora is pursued. This promotes knowledge of the environment and the interaction of users with the river as a generator of natural life.
The intervention allows connectivity between all the city's parks, which are thus integrated into a large park articulated by the corridor. This ecological connector uses mechanisms to manipulate and transform the landscape, promoting the conservation and sustainable use of biodiversity. Specific vegetation is also implemented at road intersections to guarantee the natural connection of each section [figure 15].

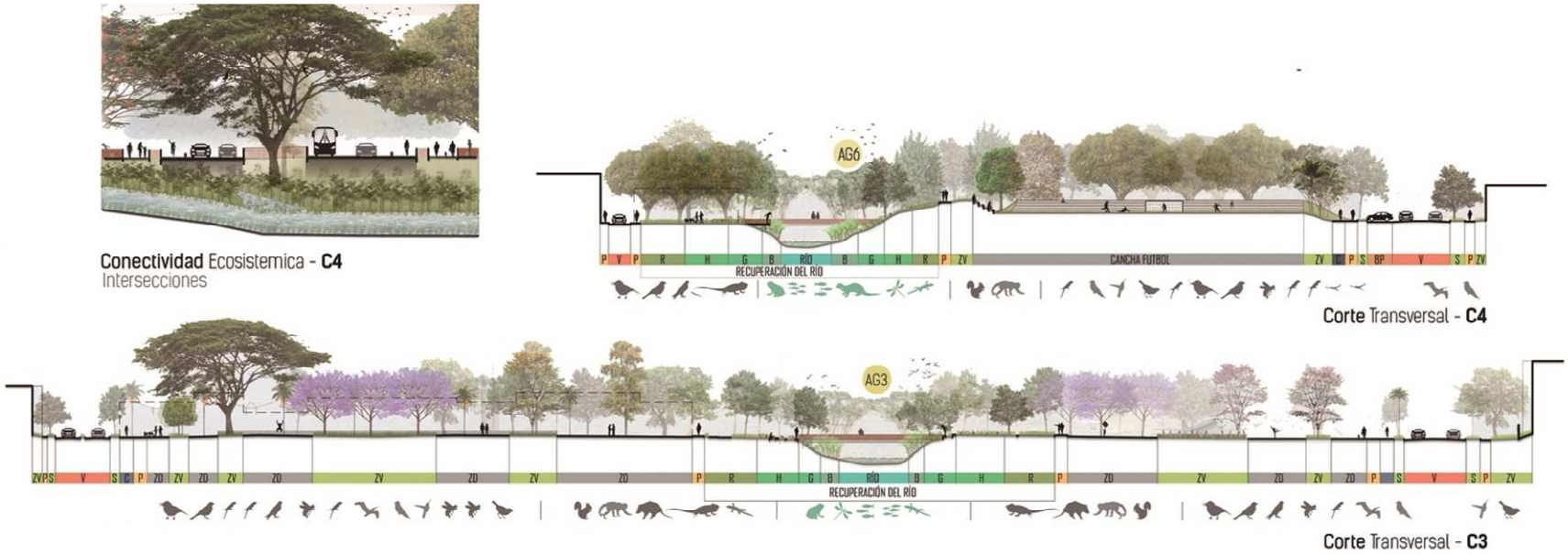

Fig. 15. Connectivity. Project for the urban environmental corridor of the Cali River, Colombia. Alcuadrado Architects.

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ISSN 1828-5961

A special mention deserves the analysis of the representation used by the authors of the project. The skill with which they handle the different scales is admirable, from that used to represent the urban fabric to the detail to define the urban project. There is a successful adaptation of the graphic definition with the choice of the representation systems used. The authors use the plans at a quasi-territorial scale to include the entire corridor of more than eight kilometres in length in a single planimetry. They use resources such as colour schemes, legends, photographs, icons and organization charts, besides generating an effective guide plane to define the arrangement [figure 16] on a scale that would not have been possible using lines. They thus allow intuitive and very efficient reading of plans. There is no shortage of connection diagrams [figure 14] and intervention phases [figure 19].

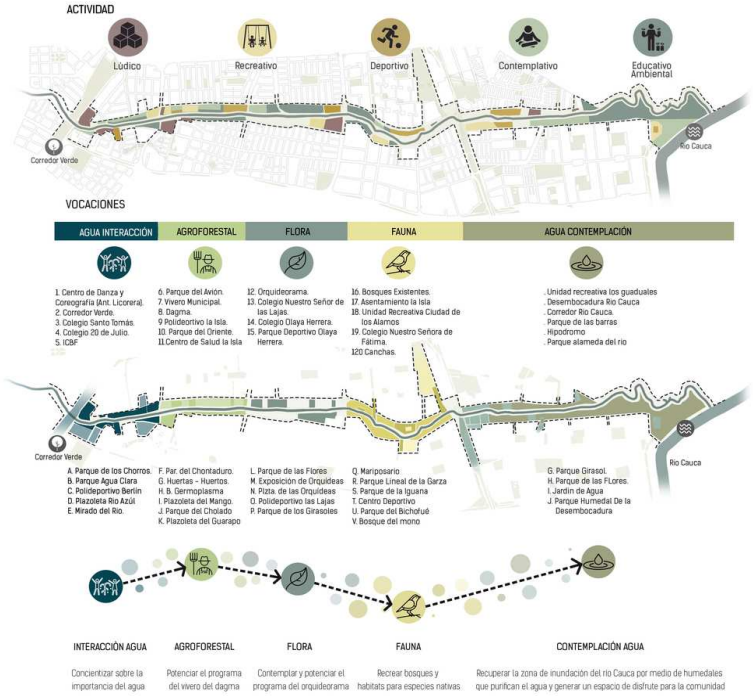

Fig. 16. Program to be developed. Project for the urban environmental corridor of the Cali River, Colombia. Alcuadrado Architects.

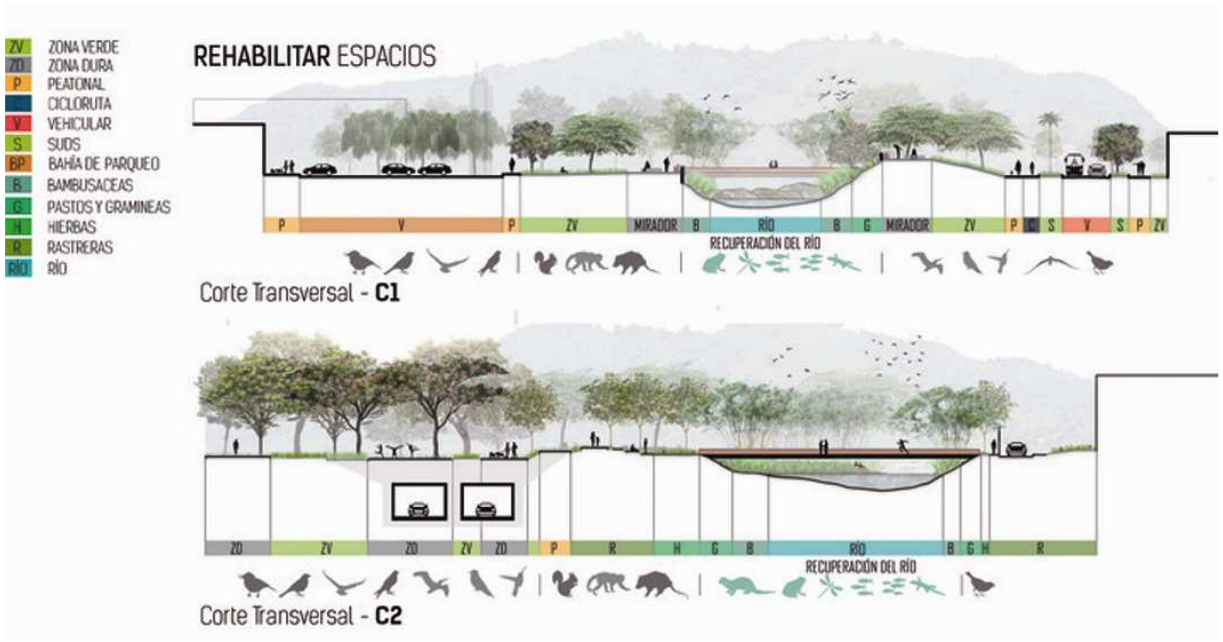

Fig. 17. Sections as a tool to represent the rehabilitation of spaces. Project for the urban environmental corridor of the Cali River, Colombia. Alcuadrado Architects.

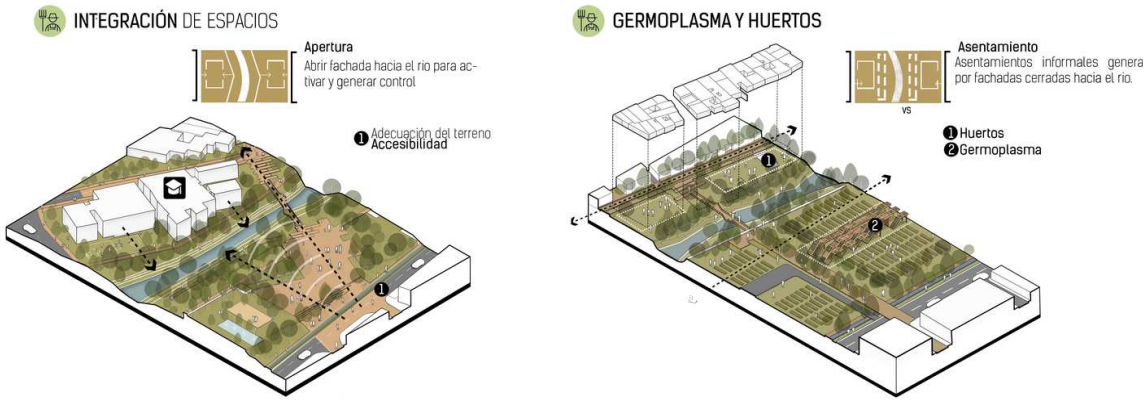

Fig. 18. Integration of spaces and germplasm. Project for the urban environmental corridor of the Cali River, Colombia. Alcuadrado Architects.

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The sections take on a special meaning [figure 17], being a project that intervenes on riverbanks, the orography is decisive when making project decisions. The authors define the vegetation exhaustively in these representations through the intensive use of frames in the upper part. At the bottom, a linear band defines the plant species used, while icons define the animal species that inhabit the previous ones.
There is an important analytical burden, especially visible in the axonometrics used to represent specific parts of the proposal. Using a rectangular cut out of different intervened sections, an orographic base of the natural and built environment is raised, and diagrams with graphic and written explanations are then superimposed [figure 18].
But it is the perspectives that provide the most descriptive and spectacular representation of the project. Using high-definition graphic rendering, photorealistic images are achieved. Three of them use an aerial perspective and show a panoramic view of the entire proposal. The other four define specific situations that simulate the users' journey through the different scenes projected by the authors. One of them, using an unusual resource, incorporates a section in its lower part constructively defining the execution of the vials [figure 19].

Fig. 19. Perspective with construction section of the project for the Urban Environmental Corridor of the Cali River, Colombia. Alcuadrado Architects.

CONCLUSIONS

The search for adecuacy is called adaptation. Green corridors, such as Cali, offer opportunities to improve the quality of life in urban environments while promoting biodiversity and addressing environmental and social challenges associated with urban development. Its integration into architectural and urban planning projects, based on the recreation of its landscape and the development of its biological connectivity, can contribute significantly to the creation of healthier, more sustainable and habitable environments.

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The Cali River corridor, which complies in a very particular way with all the precepts of the environmental-urban corridors previously exposed, responds to a genuinely interdisciplinary thought that maintains ecology as a harmonious link between human and natural systems, being a clear exponent of the McHarg method [15] when projecting from the resources provided by nature. Its design has prioritized the improvement of the vegetal and functional-ecological coverage of the entire AFP of the Cali River in its urban route.

Its implementation has represented a new ecological, educational and adaptive reuse paradigm, introducing a rich and diverse wildlife platform to generate a dynamic space –both urban and natural–. In this space, the ecology of the soil, water, air, vegetation, fauna, together with the program of recreational, cultural, educational-environmental, landscape-contemplative activities will create a new prototype of a green South American city. The eco-technologies used, together with an adaptive administration, will provide a new humanistic vision that will promote environmental, territorial and social sensitivity.

In 2020, interventions aimed at creating the Cali corridor began. Two years later, a second phase continued. Although what has been done to date is still very far from reaching what was projected [figure 20], rather than serving as a criticism, it demonstrates how ambitious the plan was from its origin. Perhaps this should make us reflect on the economic viability of these interventions and their suitability depending on which locations. But there is no doubt that this project, betting on the integration of human activities in the natural environment, has managed to raise awareness and excite the community. And thanks to the magnificent drawings and graphic representations used to capture its ecological design, which stand out for exuberantly reviving the organic elements of the proposal, it has made known and disseminated the benefits that green corridors offer to society as a whole. In summary, as Ian L. McHarg already pointed out as the objective in the sixties: "restore the Earth, return its greenness; cure her" [1969, p.15].

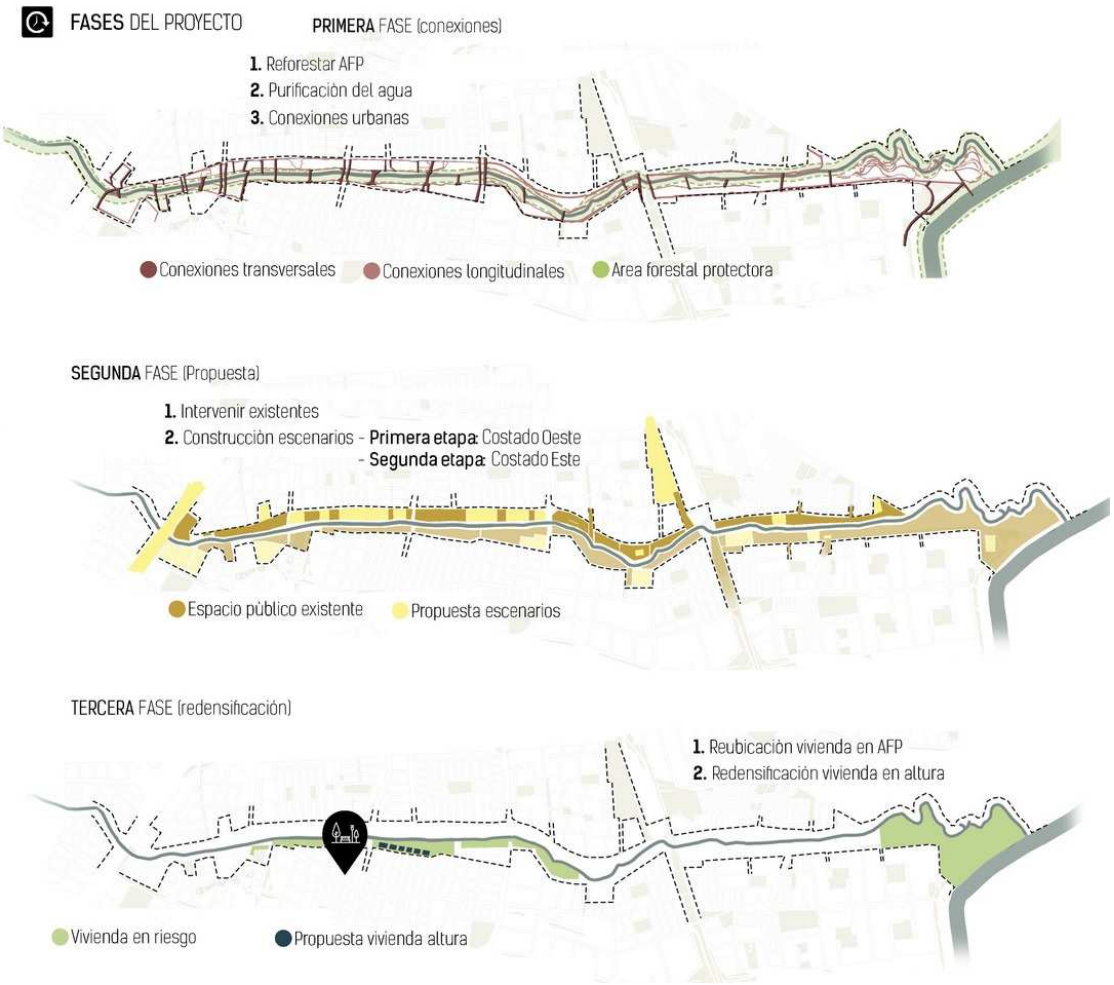

Fig. 20. Project execution phases for the Urban Environmental Corridor of the Cali River, Colombia. Alcuadrado Architects.

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NOTES

[1] The concept "green corridor" and "corridor" are neighbouring ideas: a hedge is a corridor for an ecologist who studies the movements of forest species, and a green corridor for a technician who implements a linear element for environmental reasons.

[2] Since these studies are mainly based on approaches aimed at developing models or on specific empirical data, but very rarely on experimentation [Lindenmayer & Nix, 1993].

[3] In the US these groups are called “bioreserves”; they are made up of several central zones, with greater protection measures; a series of concentric zones that serve as a buffer zone and where management restrictions are less strict; and a series of corridors that relate these sets to each other [Barret & Barrett, 1996]. The level of protection of each area depends on its relationship with the central zone and the conflicts arising from potential uses. These concepts preside over the current large conservation projects –Natura 2000 network, ECONET network–.

[4] A corridor created parallel to a high voltage line or in the intermediate space of a highway does not necessarily respond to environmental or faunal requirements. To be sustainable, management must be effective and consider all the cultural aspects of the landscape.

[5] These principles became widespread in the 1980s [Harris, 1985].

[6] Implemented by the US Fish and Wildlife Service and the Texas Parks and Wildlife Department; mainly created to safeguard the large American felids.

[7] In the 1980s, due to rapid urban expansion, Florida suffered rapid fragmentation of its natural habitats and marshes.

[8] Between the Stelvo National Park –Italy– and Switzerland; its greatest commitment is to facilitate deer migration.

[9] It was ratified in 1995 by 46 countries that committed to its creation within ten years.

[10] The European Natura 2000 network, the Berne, Bonn and Ramsar conventions, the biogenetic reserves of the Council of Europe, the reserves of the International Union for Conservation of Nature –IUCN– and the ECONET model.

[11] Hobbs and Wilson [1998] presented the progress of research on the role of corridors as wildlife conductors.

[12] Alcuadrado Arquitectos –Alexander Espinosa Pai, Luisa Aponte Morales, Luisa Arango Vásquez, Laura Núñez Rojas– + Habitar Colectivo –Duver Alarcón–; Environmental advisors: Maria Leonor Bayona Esguerra and Silvia Shiess. Together they won first prize in 2018 in the *National Public Competition for the Environmental, Landscape and Urban Design of the Environmental-Urban Corridor of the Cali River*.

[13] Seven objectives are deduced: 1 water recovery; 2 Recovery of the protective forest area; 3 implementation of tying staples between edges; 4 creation of a living museum or BioParque; 5 rehabilitation of recreational spaces; 6 generation of ecosystems; 7 allow connectivity between the Farallones National Park, all urban parks and the Cali and Cauca rivers.

[14] Understanding the term “ecology” as dictated by L. Mumford: as “the set of knowledge that encompasses all aspects of nature” [McHarg, 1969, p.17].

[15] The method that Ian McHarg defined in *Design with Nature* [1969] basically consists of understanding the processes that shape landscapes and using them as the basis of the project, analyzing and ecologically planning the biophysical and sociocultural systems of the place to reveal where they should be established with the greatest suitability the specific uses of the land.

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