CHARACTERIZATION OF ECOSYSTEM SERVICES IN THE “QUEBRADA LA IGLESIA” LINEAR PARK, IN THE MUNICIPALITY OF BUCARAMANGA, SANTANDER, COLOMBIA

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ABSTRACT

In the cities, the conformation of an urban environmental structure, means first of all, the recovery of the natural spaces articulated to the development of the city, where it is protected, conserve and facilitate the contemplation of resources such as water, the vegetation constituted by the flora and fauna, and its effective articulation through green corridors or parks, which may be located as linear tracings of the topography or enclosed in the road layout of the city, recognizing as trails, linear parks or urban parks. The city of Bucaramanga, capital of the department of Santander, in the last twenty years, presents important urban transformations, marked by its position as the epicenter of development of the Northeast of Colombia, with which the housing demand and consequently of city infrastructure, increased to attend to the attracted inhabitants. This dynamic city has begun to be intervened, and promoting initiatives for recovery and protection of natural spaces, which are able to strengthen and integrate sustainably into the consolidation of the city.

The development of the Project proposed as a methodological process the initial review of successful experiences of identification of ecosystem services of urban natural spaces, as a work reference, to proceed to environmentally characterize the broken linear park of the church, identifying its available natural resources and recognize the services Ecosystems generated by the microbasin intervened to sustainably use it as a linear park, associated with the urban environment. The Project ends up intent on generating a contribution to the understanding of the environmental value that the study area has, as a provider of goods and services, fundamental for the environmental sustainability of the communities in the urban area of the linear park.

KEYWORDS: Linear Park, Ecosistemic Services, Urban Ecosystems, Basin, Urban Environmental Sustainability

Received: Sep 27, 2020; **Accepted:** Oct 17, 2020; **Published:** Nov 10, 2020; **Paper Id.:** IJMPERDOCT202037

1. INTRODUCTION

The amount of benefits that nature provides to the human being guarantees its subsistence, among them we find elements such as water, wool, food, and medicines, likewise nature offers opportunities of recreation, spiritual realization and cultural inspiration [1][2], those natural systems that are in a healthy state with a great diversity of animals and plants contribute to the mitigation and adaptation to climate changes; the investment of a healthy environment can be considered as a luxury instead of life insurance.

These benefits provided by the ecosystem are known as ecosystem services, have been defined by FAO in terms of the service and welfare they provide to man and society, which are often perceived as free [2] [3], the excessive use of these resources leads to a loss of natural capital, through the valuation of ecosystem services can be defined a more complete picture on the different benefits provided to properly value them [4]. The concept of

ecosystem services is made more explicit by showing the dependence of a society on its well-being and the conservation of proper ecosystem functioning. When ecosystems are altered, their quality of life is affected, generating environmental and social changes [5] that cannot be solved in the short term; however, the least favored communities are those who depend most on these services and are therefore the most affected by ecosystem transformation.

Thus, it is necessary to develop comprehensive analyses to understand the various variables that affect the processes as a fundamental contribution to decision making. Comprehensiveness includes biophysical and cultural characteristics of the value, and not only from a monetary point of view, which reflects the multi-functionality of an ecosystem, to make the valuation more complete as a tool for land management, which will benefit local communities and society in general [5]. Both inside and outside of cities, ecosystems satisfy human needs as a source of resources or a destination for waste, and they provide goods and services that are vital for their functioning. Human beings concentrated in cities are directly affected by changes in the services and goods of nearby landscapes, just as vegetated spaces in cities such as green corridors, urban reserves, and parks are part of the environments that can be found around buildings, thus forming urban landscapes.

Cities currently contain more than half of the world's population and are constantly expanding, which has led to greater pressure from residents on natural resources within and outside the limits of urban ecosystems. [6] Changes to these more urban landscapes and the degradation and loss of vegetated areas lead to a deterioration of ecosystem functions and services, and a decline in these.

La Quebrada la Iglesia is a micro-basin on which the city of Bucaramanga has developed. It begins on the eastern hills of the city, entering the San Martín neighborhood, and moves southwest toward the municipality of Giron, ending eight kilometers down the Río de Oro.

Despite the small size of La Iglesia Creek, it has been an important place for the community, due to its green areas and its extensive fauna; but the abandonment of this and the different anthropogenic activities carried out in its surroundings considerably affected this creek, which is currently in a mixed condition, since 800 meters of its section are channeled in a closed manner (the water is inside a sealed pipe or structure) and the rest of its course is channeled in an open manner (it is intervened with a canalization but in the open air); The floods presented by the latter have caused flooding and overflows in commune 9 of Bucaramanga, affecting the inhabitants of the area [8].

The linear park Quebrada la Iglesia was designed as an environmental infrastructure, which harmonizes the urban development and the natural spaces of the city, it was thought to be built along the watercourse, generating technical conditions of protection and conservation of the water resource, since this is not only a line: It is a complex ecosystem with environmental and landscape connections; its conception is based on the adequate management of floods where the environmental respect of the ravine's round and the adaptation of the landscape architecture to those forms: conformation of forests, rain and water gardens, recovery of trees, implementation of urban vegetal cover [9]. Its construction benefits the social conditions of residents and visitors to the project area since it implements strategies of social sustainability related to: housing, income, employment, social and community organization, education, and training associated with productive projects, environment, health, safety, and connectivity, among others. Additionally, the population benefits from large-scale housing projects in the area of influence of the stream, where different types of housing and diverse economic activities are mixed to avoid processes of segregation and

degradation.

2. MATERIALS AND METHODS

2.1. Study Site

The Quebrada la Iglesia Linear Park is located in the basin of the Quebrada la Iglesia, which crosses the city from the eastern hills in the La Flora Ecological Park, descending in a south-westerly direction between the southern and south-western municipalities, until it borders the southern municipality with the road that connects the municipality of Giron, ending in the sector of Puente el Palenque in the Rio de Oro, which borders the escarpment of the geological formation of the Bucaramanga plateau. The Parque Lineal is a large green area with a length of 9.1 kilometers and spaces for walking, resting, sports, and cycling [10]. Image.1 shows the general panorama of the Linear Park. Its consolidation is designed in 9 sub-sectors, with the intention of achieving a greater intervention and management of this urban environmental territory.

The sub-sectors are: 1. Parque La Flora - Parque Extremo (1.1 Km), 2. Parque Extremo - San Luis (1.12 Km), 3. Ladrillera - Dirección de Tránsito (1.32 Km), 6. Dirección de Tránsito - Cenfer (1,02 Km), 7. It goes to the Palenque Bridge.

Figure 1: Overview Linear Park Quebrada la Iglesia

2.2 Investigation Process

The methodology used is based on a descriptive research approach, since it seeks to represent the reality of situations, events, people, groups, or communities. With this methodology, the reality of the area of study is described, identifying its constructive conditions and the variables of reality in its natural consolidation. From this, the ecosystem services provided by the urban basin of the stream are characterized analytically, and how these are presented with the intervention of the riverbed, under the scheme of a linear park. Sequentially, we proceed in three research moments.

Phase one, to document the existence of parks under linear schemes, as a means of protection and conservation of ecosystems associated with watercourses and their integrity in urban spaces as a balancing infrastructure of urban contexts and strategy for building sustainable cities. Phase two, Characterize the ecological

conditions of the ecosystem of the ravine basin, to identify its biotic, soil, and water resource composition, in relation to the ecosystem services it provides. In addition, to characterize the riverbed of the ravine as an environmental axis for the development of the Linear Park and to establish the constitution of the riverbed intervened and strengthened by the urban infrastructure.

Phase three, Identification of Ecosystem Services, with the purpose of protection and conservation, intervened by the infrastructure of the ecological park, as a mechanism for the protection of the ecosystem within the urban development of the city, with sustainability guidelines that allow the enjoyment of the environment as complementary spaces to the urban space.

3. DEVELOPMENT AND RESULTS

3.1 Linear Urban Environmental Infrastructure

At the global, regional, and national levels, there is a wealth of experience in the valuation of ecosystem services as a source of human well-being. Although for Colombia the concept of a linear park is relatively new, in the world, the strategy of developing civil works infrastructure parallel to the course of a body of water has been developed as a strong strategy to achieve the development of the city in respect and balance of natural agents, achieving the enjoyment of these spaces without leaving the city and without ceasing to contemplate the landscape as a city scenario. In the global scenario, the integration of ecosystem services in development planning takes into account environmental and economic commitments, which are related to development measures, systematically incorporating opportunities and risks related to ecosystem services in planning and strategy development [12].

Urban ecosystems are necessarily identified, by their potential for ecosystem services and landscape metrics analysis, to assess their structure (fragmentation, heterogeneity, connectivity), their spatial differences (e.g. at the municipality level), and how the structure regulates the ecosystem services affecting them also in their spatial dimensions. [13] In the urban space the processes or productive socioeconomic factors, condition the landscape therefore the environmental factors must be articulated in this context and must integrate human and environmental factors to explain and plan adequately their use. The identification and valuation of natural coverages within the urban space have been explained from the existence of ecosystem services that improve the quality of life. Studies developed in Germany, Spain, France, Italy, among others, agree in identifying a socio-ecosystem [14], approach from which they need to evaluate urban and peri-urban ecosystems with different tools such as the estimation or measurement of ecosystem services and landscape metrics analysis are identified and described [13].

In countries such as Guatemala, the development of linear parks is recognized as important for the social and physical development of citizens. These spaces act as a node of citizen integration for people while satisfying their different needs for recreation and sports, which vary from one citizen to another [15]. [15] Under this vision, ecosystem services are not the fundamental purpose; priority is given to the sense of recreation that inhabitants can identify in the enjoyment of infrastructure spaces built around watercourses with urban sections. On the other hand, countries such as Honduras, Nicaragua, and Puerto Rico have made important progress in payment schemes for ecosystem services, especially those related to watersheds, where the study and design of alternatives that guarantee financial sustainability for the actions to be developed and to assume responsibility for the management of natural resources with an integrated watershed management approach is considered to be of fundamental importance [16].

A study conducted in Venezuela on the development of linear urban spaces for citizen enjoyment in Latin America [17] describes these as places of passage that connote the idea of fun, of casual and frivolous encounters, where collective life is staged and, as in the theater, one sees and is seen by others. In Colombia, cities such as Medellin have developed urban environmental infrastructure zones around waterways, for which they have characterized the environmental services currently provided by the zone by envisioning their existence in the future park and identifying their benefits, thus exposing the importance of conservation in the zone, which will facilitate decision-making and city planning.

3.2. Conditions of The Ecosystem of the Quebrada La Iglesia Basin

The recognition of the ecosystem that is configured in the urban basin of the ravine of the church in the city of Bucaramanga has been described from the conditions and characteristics of: the resource Water, as the main actor of ecological existence of the basin; the resource ground, as the support of all the social, ecological and environmental processes that can be developed from the uses of the ground and economic activities of the urban space; and the biodiversity to recognize and to understand the forms in which the life is developed, in this natural space intervened by the urban development of Bucaramanga.

3.2.1. The Water Resource

Natural water source: Quebrada la iglesia

Ichthyofauna habitat: There is no evidence of fish, due to permanent discharges in the main channel. Supplies nearby communities: The body of water currently does not have the minimum legal conditions of potability. Water Quality: Highly polluted, its tributary has wastewater discharges from the communities surrounding this stream. Water tributaries: Quebrada la guacamaya, Afluente Chocontá, Quebrada La Potreta, Quebrada El Carrasco, Quebrada La Represa, Quebrada El Macho. State of conservation: According to the POT of Bucaramanga the ravine is in an urban protection zone. The entire creek will be put at the service of a renewed vision of water through educational, emblematic spaces that represent the environmental, cultural, and social values of water [9].

Figure 2: Panoramic path Linear Park Quebrada La Iglesia [26]

3.2.2 Of The Soil Resource

From the municipal POT of Bucaramanga, it describes the conditions and characteristics of the soil in the urban component. Also, in the General Plan for Erosion Control in the Municipality of Bucaramanga, there is a detailed description of the areas of erosion and soils with characteristics of special attention or environmental impact. The city's environmental authority, Corporación para la Defensa de la Meseta de Bucaramanga (CDMB), has elaborated the Evaluation of Stability and Pre-design of Corrective Measures in the sector of Quebrada la Iglesia [18], from which the information on soil resources is derived.

In general terms, it presents the following characteristics:

- General topography: Slope from 2% to 7%, of rough condition.
- Organic horizons: This unit is located towards the middle of the studied area, left flank of La Iglesia Creek, finding outcrops up to 3 meters, but its total thickness is unknown and may be greater than 10 meters.
- Edaphological conditions:
- Gravelly: This level is continuous, appearing towards the upper middle part of the escarpments that limit the northern sector of the Nueva Fontana and Ciudad Venecia neighborhoods. Northeastern sector of the Polideportivo. It is made up of pebbles and blocks, of quartz sandstone and quartzite, embedded in a sand-clay matrix.
- Red Silt: This unit has an average thickness of 1 meter and is covering the Gravity member whose contact is gradational, presenting itself as a continuous level, located towards the top of the escarpments.
- The soil of Alluvial Terraces: They are sediments that have been transported and deposited by the ravine La Iglesia, conforming the active channel, the flood plain along with a low terrace, part of which is used at the moment like a zone of grass for cattle raising, These materials are conformed by rounded to subrounded edges and blocks of quartz-sandstones, quartzite and gneisses, embedded in a sand-clay matrix of yellowish cream gray color, some of these blocks reach up to 1.5 meters of diameter. They are moderately compact, presenting high porosity and permeability.

3.2.3. Geological Conformation

Active Coluvial Soil: Deposit of mixture of materials product of the collapse of the slopes located towards the east of the bolo fields and towards the north zone of the Nueva Fontana and Ciudad Bolívar neighborhoods. These deposits are quite loose, permeable, arranged chaotically, reaching an approximate thickness of 1.5 meters, composed by blocks and edges of the soils of the Gravity member and Red Silt mainly, embedded in the sand-clay matrix. **Inactive Coluvial Soil:** The inactive colluvions have not presented recent movements and are characterized by a moderately compact matrix and rock fragments of variable size, less than 0.30 m, moderately altered, from angular to subangular shape, composed mainly of sandstones, quartzite, and gneisses. The matrix is sand-clay, light gray to yellowish, which occupies more than 70% of the deposit. These deposits are located in the hollows, towards the base of the escarpments that limit to the north the neighborhoods Nueva Fontana and Ciudad Venecia, reaching an average

thickness of 1m.

Type of vegetation cover: Native forest with bushes (Bn/Ar). They are forests that are equally protective of the soil, whose predominant species is the guadua; generally, it is found near the banks of water sources (rivers, streams, and ditches) forming small areas of protection and conservation.

Secondary Forests for Protection and Extraction (Bs). Also called seminatural because it is a vegetation originated by the process of natural regeneration after the elimination of the primary vegetation by natural causes or by the action of the man. Furrowing Meadows for Recovery and Agricultural Exploitation (Pr). It comprises the area of land formed by different types of coverage from grasslands, small stubble, and natural grass, among others. They are mostly the result of crop rotation or land abandonment. Built-in coverage. Built area: The only construction that is found in the area is the same linear park with a path, central axis, and complementary works for the passive leisure enjoyment of the space, around it is tree-lined, in the same way, two constructions predominate where the security personnel is located. It is planned that the total area of the linear park La Iglesia will be 16.1 ha [10], this when the construction of the park is finished. The total area of intervention of the Master Plan will be 347 hectares, which considers that the public space is constituted by the metropolitan park, which together with the linear park, the church will have 73.5 hectares. Scattered Constructions. Coverage where constructions are identified with residential purposes located in the urban area, isolated houses in farms and lands; they are also dispersed with institutional purposes such as schools, sports centers, health centers, communal houses, etc. On the map, they are represented by black dots.

Areas with erosion: 8 ha

Distribution of land uses for the creek: Because the construction of the park has not been contemplated in its entirety, part of the area proposed in the Master Plan was taken as land use for the park: Dotacional: 172,838 m², Commerce 101,526 m², Housing 218,914 m², Industry 81,222 m², Tourism 41,172 m², Offices 12,760 m², Event Center 22,800 m².

Figure 3: Entrance and trail Linear Park Quebrada la Iglesia. [27]

3.2.4. Biodiversity

The description of the flora and fauna present in La Iglesia creek is based on the municipal POT, the strategic projections of the Municipal Development Plan, and the information consolidated in the city's environmental authority CDMB [19]. Area in natural spaces: 21.29 Ha [20]. Flora species: *Psidium guajava* (Guayabo), *Tabebuia chrysantha* (Yellow Guayacan), *Phitecellobium saman* (Saman), *Tabebuia rosea* (Pink Guayacan), *Ceiba pentandra* (Witch Ceiba), *Melicoccus bijugatus* (Mamon), *Erythrina fusca* (Bucaro), *Manguifera indica* (Mango), *Gliricidia sepium* (Matarratón), *Anacardium excelsum* (Caracoli).

Also, it is important to recognize the type of territorial habitat on which the flora and fauna of the ravine are presented and which are strengthened with the construction of the linear park, the POT of the municipality, describes the generalities of these living spaces [21]: The prairie, this habitat presents very favorable characteristics for the life of many species. It usually occurs in areas of the planet that have a temperate climate. Rodents and small animals are characteristic of this zone; this type of habitat is present in the park around the area of influence of this one since its construction was planned in a place that is surrounded by vegetation. Forest, is an ecosystem where the predominant vegetation is the trees. These communities of plants cover large areas of the globe and function as habitats for animals and other plants that occur around them, such as mushrooms, ferns, the presence of forests in the park is due to their soil types, however, these are relics of vegetation as they are small scale and quite dispersed.

Quebrada, is a stream, small river or creek, of little flow if compared to an average river, and not suitable for navigation or significant fishing. In the ravines, usually, only very small fish species live; the ravine in the park is in very bad conditions preventing it from being the habitat of some species, and the water that would provide the present fauna would not be the most optimal for their consumption. Grasslands, these are areas where there is a great concentration of grasses and the subsoil tends to be dry, but its surface maintains a seasonal humidity; the grasslands are found in the same way as the prairie around the park in very few parts of the stretch being these in a reduced size.

Figure 4: Internal section of the trail Parque Lineal Quebrada La Iglesia. [26]

3.3. Characterization of Ecosystem Services

Ecosystem services, defined based on FAO [22], are considered in four major groups according to the services they provide: Supply Services, Regulatory Services, Support Services, and Cultural Services. According to this grouping, the following characteristics have been identified in the basin of La Iglesia Creek:

Park Regulation Services at La Iglesia [2] [23]

Regulatory benefits are obtained directly from ecosystems without going through transformation processes or markets; they include clean air, maintenance of biogeochemical cycles (CO₂ /O₂ balance, the ozone layer, etc.), the protection offered by ozone against ultraviolet rays (UVA), disease prevention and maintenance of water quality, among others (Tapia, 2000).

In this context, the range of ecosystems on the planet, and particularly in Latin America, provides various ecosystem services that have been classified in different ways. 23] There is an important, often blurred distinction between human impacts on the biosphere and the impact of the biosphere on human well-being; although the two are clearly distinct, they are closely related. Thus, human health and well-being are in the long term contingent upon maintaining the integrity and resilience of the ecosystems that comprise it. 23] The fact that conventional economic theory has ignored this fact has been identified as a fundamental cause of the current ecological crisis.

The services associated with local climate and air quality, carbon sequestration, and storage, conversion of carbon dioxide into oxygen through photosynthesis, moderation of extreme events, prevention of erosion and conservation of soil fertility, pollination, and regulation of water flows, are incorporated into the construction of an environmental services park. 7] that will guarantee its articulation with the whole city. It will be completely linked to the mountain and the forests of the context by means of wooded areas that will additionally guarantee the control of emissions and improve the landscape of the place. Within the park, a nursery will be consolidated for the production of tree species to be available throughout the city. All these activities will be arranged in surrounding forest areas that will reduce and control their impact.

Protection and Supply Services [2] [24]

Water, food, wood and other goods are some of the material benefits that people obtain from ecosystems. Raw materials are understood as a great diversity of materials, such as wood, biofuels and fibers of cultivated or wild plant and animal species. In addition, Medicinal Resources are recognized as a diversity of organisms that provide effective remedies for many types of health problems.

With the construction of the park, the aim is to create a metropolitan water park. Where all the streams will be put at the service of a renewed vision of water, by means of pedagogical, emblematic, and representative spaces of the environmental, cultural, and social values of water. The linear park in La Iglesia ravine seeks to make the water circulate, creating wetlands to retain it and improve its quality. [7]

Figure 5: Internal section of the trail Parque Lineal Quebrada La Iglesia. [26]

These protection services are envisioned in the master plan of the linear park, from the landscape strategy, in which the project is crossed by trails and pedestrian walks taking advantage of the various components of the water landscape. It establishes routes through a network of mountain walks, directly linked to forest species, relics, and places to contemplate the unique characteristics of the relief, such as escarpments, ponds, etc. This is strengthened with native species throughout the project. The aim is to recover the cultural, environmental, and landscape values of the species that are typical of the place. [24].

The linear park seeks to articulate the new wooded areas, which are consolidated with the value of the ecosystem's system and conservation, to the idea of recovering the water and forming urban forests, complementary to the other linear spaces of the city.

Supply Services Park the Church [2][23]

Support. These services are identified in the provision of vital spaces for plants or animals and the conservation of a diversity of plants and animals. The identification of Habitat for species, provide living spaces for plants and animals; and the Conservation of genetic diversity is recognized.

In the linear park, these services are strengthened based on the project's ecological strategy, given that in it, based on the protection, conservation, and sustainability of water, the vital spaces necessary to develop a robust tree cover are built, in which, as already related in the Protection services, with a prevalence of native species, endogenous ecosystems are promoted, the reconstruction of the soil and the consolidation of life niches for specific animal species in the city's life zone.

This favors a genetic strengthening of the vegetal and animal individuals, for their permanent renovation in natural scenery and their possibility of adaptation in rhythm to the cosmic changes that the creek evolves from the existence of the park. In the words of the park's master plan, the use of native species throughout the project seeks to recover the cultural, environmental, and landscape values of the species native to the area. Also, it seeks to articulate the new forest groups to the idea of recovering water.

La Iglesia Park Cultural Services [2][24]

Cultural. The non-material benefits that people obtain from ecosystems. These services include aesthetic inspiration, cultural identity, attachment to the land, and spiritual experience related to the natural environment.

These services are recognized in the development of recreational activities and mental and physical health understood as recreational opportunities based on nature. Tourism comprises both benefits for visitors and income generation opportunities for natural tourism service providers. Aesthetic appreciation and inspiration for culture, art, and design, recognizing that animals, plants, and ecosystems have been the source of inspiration for much of our art, culture, and design. And the spiritual experience and sense of belonging, which recognizes in nature, a common element in most major religions.

The contribution of the linear park, to the strengthening of these directly intangible services, can be represented in the benefits it radiates to the urban areas surrounding the intervened natural course, for which it is proposed as an important and attractive opportunity for the metropolitan area to obtain new housing, equipped with the best urban services and with great environmental, landscape and urban quality.

The master plan of the linear park states that "the gross area of the master plan is 392 Ha, where about 800,000 m² built through the proposed projects are generated, of which about 330,000 m² correspond to new housing (40% of total meters built) of which 37.7 Ha, or about 3,300 housing units for about 13,000 people. It is possible to balance the urbanistic loads of a project characterized by the high standard in roads, public space, and equipment".

The social vision of the linear park contemplates [7], that the urbanism of proximity promotes the increase of the inter-basin relations and of the neighborhoods with the great components of the metropolitan structure of the city. To achieve this, biotic connectivities are expanded from the linear park in the ravine to the surrounding environmental system, through tree-lined civic corridors that interrelate local parks with each other and with the metropolitan linear park, through circuits of mobility and permanent accessibility on a human scale, which link the city on both sides of the linear park with many transversal steps.

4. DISCUSSION AND CONCLUSIONS

The valuation of ecosystem services, is widely argued from the classification validated by FAO, its interpretation or preliminary recognition can be argued:

Regulatory Services:

Local climate and air quality: Thanks to the great variety of tree species present in the park, it contributes to the regulation of the climate in this area, making it relatively fresh in comparison to other areas of Bucaramanga which do not have green areas or parks as large as this one. The civil work built as a draughtsman for the park constitutes an added value for the strengthening of the climate regulation of the urban watershed ecosystem.

Carbon sequestration and storage: the construction of the linear park, and its incorporation of native

species of the region and city, contribute to the strengthening of carbon sinks. Studies have determined that a tree absorbs approximately between 10kg and 30kg of CO₂ per year.

Moderation of extreme phenomena: In the San Luis neighborhood, flooding has occurred due to overflowing creeks and avalanche areas in its soils. The canalization that generates the civil work of the park, likewise, the reforestation of the area, contemplates trees of deep roots to avoid new avalanches reducing in great measure these phenomena.

Prevention of erosion and conservation of soil fertility: Thanks to the presence of trees such as snails that have strong roots and prevent soil erosion, guava trees, mangoes, and mamón, which give fruits that fall around them and are degraded, becoming organic matter rich in nutrients for the soil, conserving its fertility.

Pollination: The presence of trees such as guava, mango, and mamón, among others, attract pollinating fauna, thus strengthening the diversity present in the park and providing shelter and food for this fauna.

Regulation of water flows: This service is provided by the small areas of forest present in the park. Its process takes place in the canopy cover on the surface and under the surface of the soil, providing evapotranspiration and infiltration.

Supply Services

Raw materials: Despite being a conservation area, it does not neglect the supply of small raw materials to the population such as fruits or wood from fallen trees.

Medicinal resources: In the pastures, it is common to find certain plants called "medicinal" for example the mint, which serves for stomach pain among others, likewise people seek to satisfy affectations caused by diseases with plants, this is more common in people over 60 years.

Support Services

Habitat for species: Since there is a diversity of these, a variety of fauna and flora can be found, the park's intervention seeks to return many species that have migrated due to the loss of forest cover. The reforestation with native species favors fauna, beetles, butterflies, bats, among other small species occupying these spaces.

Conservation of genetic diversity: The variety of flora mainly and the presence of pollinators in the park allows to continue the life cycle of these species, ensuring a seed bank to the next generations.

Cultural Services

Recreational activities and mental and physical health: The construction of the park has motivated the surrounding communities to carry out physical activities such as hiking and others within the park, this has helped to avoid sedentarism and improve in some way the health of people.

Tourism: This park calls the attention of different types of people because it is a fresh and quiet place, apart from this very close to it is the extreme sports park of Bucaramanga where a large number of

people go. Aesthetic appreciation and inspiration for culture, art, and design: Being a place where there is harmony between human beings and nature, it provides inspiration for artists and even for the architecture present in the park to be taken to another city.

Spiritual experience and sense of belonging: When the project was presented to the neighboring communities in its area of influence, they were not satisfied with the construction activities. However, when the civil work was shown, the community recognized that they had a space for recreation and enjoyment where the sense of belonging was paramount.

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