



**INTERLACE**  
RESTORING URBAN ECOSYSTEMS  
RECUPERANDO ECOSISTEMAS URBANOS

**Version:** 1  
**Date:** 3 July 2024  
**WP:** 2  
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## ENVIGADO: Land use planning and renaturalization for a Biodiverse Territory



## Document Information

<b>Deliverable title:</b>	ENVIGADO: Land use planning and renaturalization for a Biodiverse Territory
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<b>Citation:</b>	Tabares, J. 2024. ENVIGADO: Territorial planning and renaturalization for a Biodiverse territory. Impulse Document. Ecosystems and Biodiversity Directorate. Envigado Mayor's Office
<b>Deliverable number:</b>	NA
<b>Work package:</b>	2
<b>Lead partner:</b>	Envigado
<b>Due date of deliverable:</b>	27-June-2024
<b>Submission date:</b>	3-Jul-2024
<b>Dissemination Level</b>	Public
<b>Reviewed by</b>	Luis Eduardo Taborda Ramírez, and Diana López - Mayor's Office of Envigado.  Diana Ruiz and Isabel Melo: Humboldt Institute Natalia Burgos. Ecologic Institute  Marcela Gutierrez, National University of Costa Rica

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# 1. Introduction

The municipality of Envigado is an intermediate city located in the Colombian Andes in the central mountain range in the Antioquia department. Envigado has an extension of **79.85 km** and a total population of **248,304** inhabitants. The majority of the population lives in urban areas 97% (240,655) equivalent to 15% of the municipality's territory; the remaining 3% (7,649) live in rural areas, representing 85% of Envigado's territory. This territory has a mountainous topography and a high plateau zone, with altitudes ranging from 1,530 to 2,880 meters above sea level. It is in the southern part of the Aburrá Valley metropolitan area, the second largest urban concentration in Colombia, which includes 10 municipalities (Figure 1). In terms of the total surface area of the Aburrá Valley, 1,152 km<sup>2</sup>, Envigado represents 4.3% of that territory and ranks seventh in extension among the ten municipalities that comprise it.

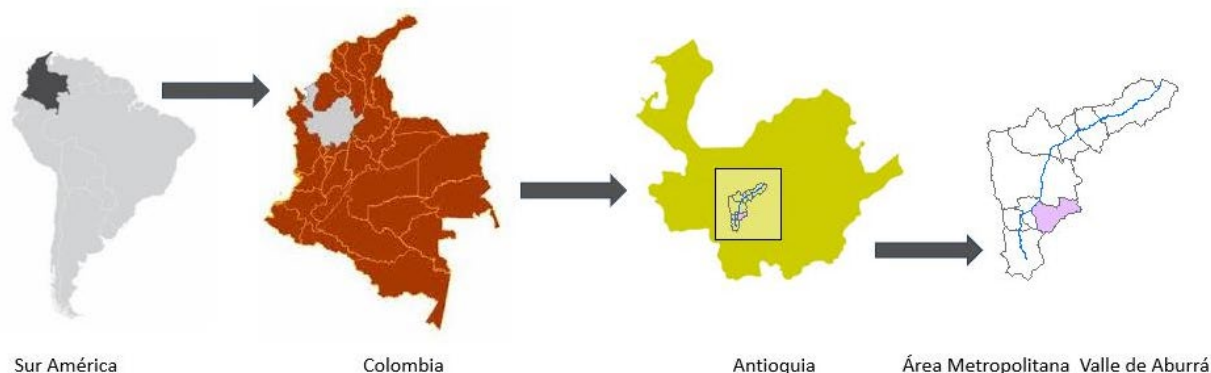


Figure 1. Location of the municipality of Envigado in the context of South America.

The municipality of Envigado is home to more than 1,800 species of fauna and flora. It is noteworthy that of the mammal species reported in Colombia, Envigado 11% of the total, a figure that is expected to continue growing due to the constant monitoring processes on protected areas. For these reasons, biodiversity has become a key aspect of the municipality's environmental agenda. This interest has led Envigado to lead regional and national initiatives on issues such as **the management of protected areas, renaturalization processes, management of urban green areas, water resource conservation, citizen participation, and social appropriation of knowledge about strategic ecosystems**. An example of this leadership is the collaborative process of incorporating Envigado's Local System of Local Protected Areas -SILAPE in its municipal land use planning validated by research and conservation institutions. As a result, Envigado has become a benchmark for other intermediate cities that seek to incorporate biodiversity as the axis of territorial planning, seek sustainable urban development and wish to implement Nature-based Solutions (NBS) as a strategy to achieve wellbeing and sustainability.

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Part of the collaborative efforts results in the participation in the INTERLACE project, funded by the European Union under the Horizon 2020 research and innovation program, of which the municipality is a partner together with 2 other cities in Latin America and 3 in Europe.



Figure 2. First INTERLACE Consortium Meeting, Costa Rica 2022.

This document presents a summary of Envigado's main strategies, which have been supported and enhanced through the INTERLACE project. Its purpose is to serve as a source of inspiration and guidance for other cities and their decision makers (mayors, office secretaries, territorial directors, autonomous corporations, private companies) interested in promoting the implementation of NbS as an effective strategy to face the challenges of sustainable development and climate change. This Impulse Paper (IP) presents four key strategies Envigado has been developing and includes benefits and lessons learned based on achievements related to the biodiversity conservation.

## 1.1 Context and relevance of the NbS in the municipality of Envigado

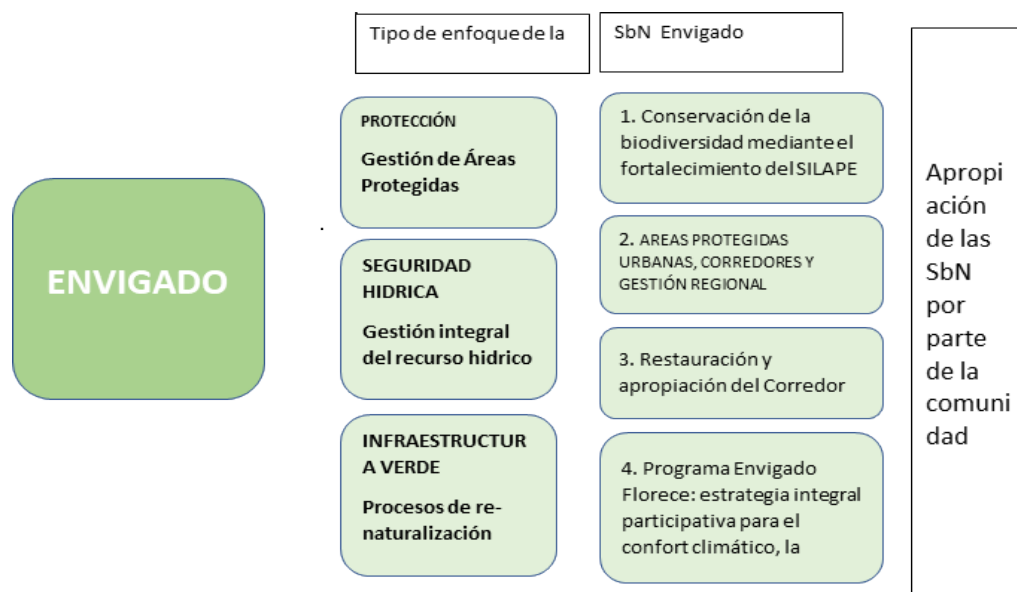


Figure 3. BDS approach in the municipality of Envigado.

The International Union for Conservation of Nature (IUCN) has defined Nature-based Solutions (NBS) over the last decades as "actions that address key societal challenges through the protection, sustainable management and restoration of ecosystems, both natural and modified, benefiting both biodiversity and human well-being."<sup>1</sup> Based on this definition, several organizations and cities have implemented these actions or reconsidered previous initiatives under the framework of the NbS.

In the case of Envigado, the municipality has been implementing conservation actions that can be considered NbS for more than 20 years, such as the Envigado Florece program. This program was established to reduce the high temperatures caused by neighborhood densification, improve urban biodiversity and human well-being. The municipality has assumed for decades that biodiversity provides a series of ecosystem services that are fundamental for human well-being, such as the provision of food, water, clean air, climate regulation, and other cultural and recreational services.

Envigado recognizes the importance of NbS to address environmental and socioeconomic challenges, and to help to generate resilience in cities, and place biodiversity as the structuring axis of its management. The use of the concept is particularly important for Envigado, as it allows integrating and valuing these actions within an internationally recognized framework. This facilitates the communication of its efforts, collaboration with other entities and the possibility of accessing global resources and knowledge to strengthen its conservation and sustainable development initiatives.

<sup>1</sup> IUCN. 2020. Ensuring effective Nature-based Solutions. ISSUES BRIEF. <https://www.iucn.org/resources/issues-brief/ensuring-effective-nature-based-solutions>.

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The nature-based solutions implemented in Envigado are essential for the conservation, protection and sustainable management of its natural resources. These strategies focus on the following aspects:

- Preservation of Envigado's Local System of Protected Areas (SILAPE), which covers 40% of the territory (Figure 4).
- Improve people's quality of life through the management of urban protected areas that contributes to the wellbeing of the community, providing green spaces for mental and physical health.
- Promote the proper management and valuation of water resources through environmental education, restoration and recovery of the municipality's water bodies, which are crucial in the context of climate change.
- Increase green infrastructure through the Envigado Florece process, which seeks to expand green coverage ( change of hard to soft grounds, and implementation and enrichment of urban gardens).

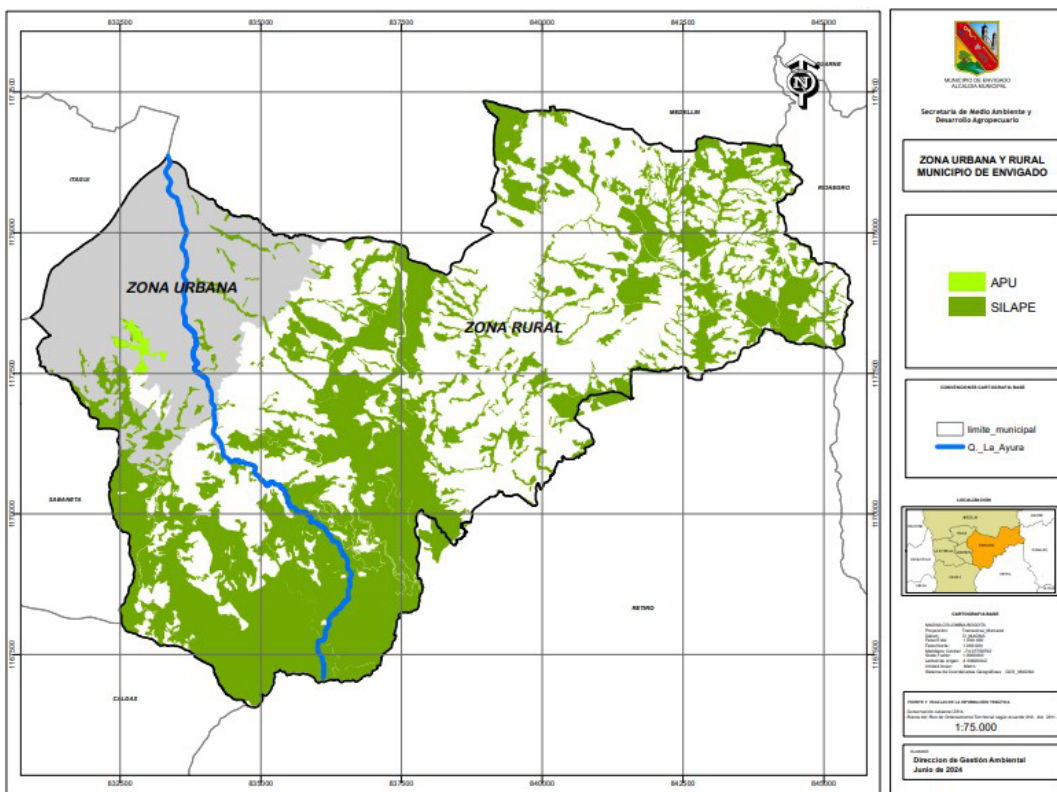


Figure 4. Map of the Local Protected Areas System of Envigado.

These NbS are implemented in response to population growth that exerts considerable urbanization pressure on protected areas and urban ecosystems, which is one of the main challenges facing the municipality. The municipal administration considers crucial to provide housing for the growing population without compromising green areas and the ecosystem services they provide, and integrates nature-based solutions as essential to address accelerated urban growth, biodiversity loss and climate change, ensuring the sustainable development and resilience of Envigado.

## 2. Actions carried out in favor of biodiversity conservation in the municipality of Envigado

### 2.1 Biodiversity conservation strategy progress (Envigado Local System of Protected Areas - SILAPE)



Figure 5. View from Envigado's Local System of Protected Areas towards the Metropolitan Area of the Aburrá Valley.  
Photo: Johana Tabares

The municipality of Envigado formed its Local System of Protected Areas (SILAPE), through Agreement No. 009 of 2016 (Alcaldía de Envigado, 2019), as a strategy for disaster prevention, climate change adaptation, conservation of biodiversity and ecosystem services and regional integrity, by maintaining the connectivity and functionality of the surrounding forests (mostly rural). In this way, the Envigado SILAP responds to a commitment to identify, declare and promote local and regional strategic areas for biodiversity conservation.

This system is made up of 3299 hectares (40% of the administrative area) of urban and rural territory of Andean forest relicts, in four conservation nuclei: Corredor del Tigrillo, Roble de Perico and Pantanillo Forests, Nare Forest Reserve and Eastern Escarpment (Figure 6).

Currently, land cover in the SILAPE shows a preponderance of forests, which represent 60.68% of the territory. This land use favors the creation of Protected Areas. Additionally, 32.47% of the SILAPE



includes land cover associated with agrarian economic uses, including: forest production, agriculture and livestock. As an import part of SILAPE, Envigado targets the conservation of woolly ocelot (*Leopardus tigrinus*), paisa frog (*Hyloscirtus antioquia*), cacique candela (*Hypopyrrhus pyrhyogaster*), tartar fern (*Cyathea divergens*), black tartar fern (*Cyathea meridensis*), ivory (*Licania abreræ*), mico pot (*Eschweilera antioquiensis*), wax palm (*Ceroxylon vogelianum*).

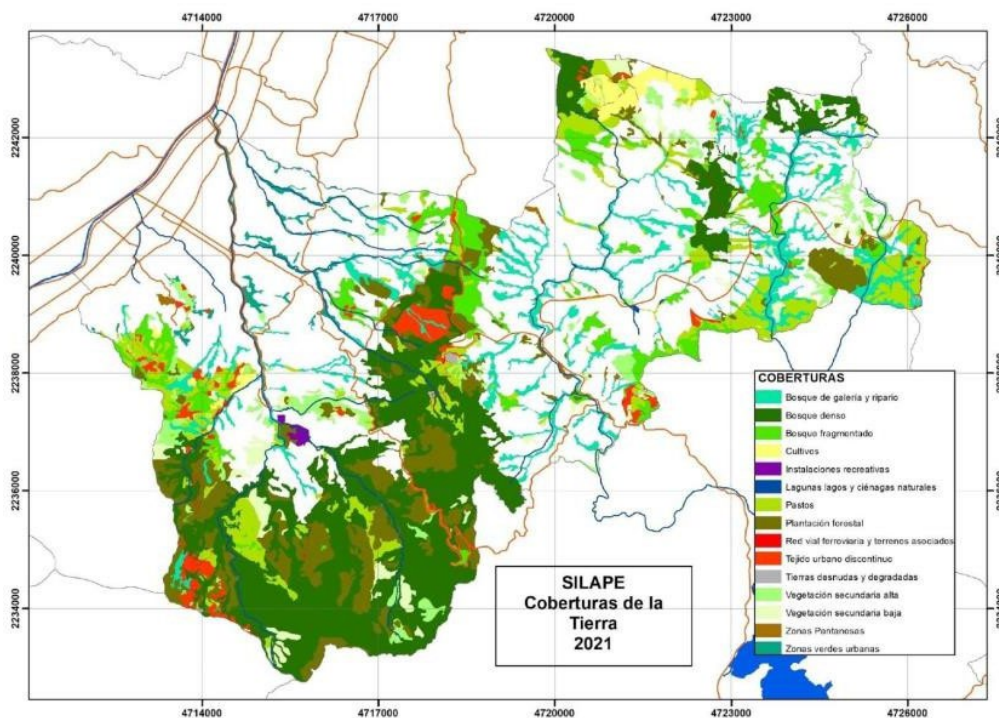


Figure 6. SILAPE vegetation cover. 2021.

Among the main actions carried out by this conservation strategy - SILAPE - are:

- Knowledge and management of biodiversity with emphasis on wildlife.
- Identification of sites and situations that generate loss of wildlife biodiversity.
- Development of arboreal wildlife crossings, underpasses and other temporary connectivity strategies.
- Forest ranger program to motivate and encourage conservation and control of initial damage to ecosystems with emphasis on the natural forest and associated species.
- Regional management for conservation (participation in SIDAP-Antioquia and in the regional roundtable for conservation in the South of the Aburrá Valley).
- Restoration (Reforestation, enrichment and other actions to improve the connectivity of the natural forest and woodland).
- Management of strategic municipal properties for conservation

### 2.1.1 SILAPE Management Plan

As part of the INTERLACE project, progress was made in the construction of the SILAPE Management Plan, which is a crucial tool for providing a solid and effective management framework for the administration of these areas. This plan, constitutes the technical support for the next Land Use Plan (POT) 2025, because it establishes a clear and forceful guidelines for effective conservation for the next 12 years, guaranteeing the protection of biodiversity and the ecological structure of Envigado.

The Management Plan contains a diagnosis of the current condition of the SILAPE areas, a management proposal based on zoning and rules for the use of natural resources and the development of permitted activities.

### 2.1.2 Benefits of this NbS

SILAPE Management Plan, consists of a mosaic of protected areas primarily for conservation, but also allows for other uses, addresses multiple social challenges. The Plan aims to conserve habitats for native and migratory species, preserve the typical Colombian Andes ecosystems; contribute to mitigation and adaptation to climate change, protect the soil and associated vegetation and improve food security and economic and social development (some of its nuclei allow forestry, agricultural and nature tourism activities).

The establishment of protected areas allows to conserve and to make visible and document local biodiversity, especially in terms of fauna and flora. In 2015, the municipality of Envigado recorded 553 species of fauna and flora using non-invasive methods, such as photodetection cameras.



Figure 7. Registration of the camera trap located in SILAPE. Photo: Municipality of Envigado.

By 2023, this figure increased to 1,878 species. This increase underscores the importance of protected areas for the conservation and knowledge of local biodiversity, facilitating the identification, protection and study of fauna and flora. Protected areas function as natural laboratories for research and education, providing intact natural environments for the study of ecosystems and biological processes. This promotes understanding and awareness of biodiversity and natural resource conservation, facilitating citizen ownership of these issues. In addition, the SILAPE water networks are key elements in planning and conservation, valued and managed by both the municipality and the community, as they contribute to the regulation of water flow and quality.

### 2.1.3 Considerations and lessons learned

Protected areas should be integrated into land-use planning regulations and be protected by municipal agreements that incorporate the SILAPE (Local System of Protected Areas) concept. It is essential for these areas to recognize their ecosystem benefits in the municipal culture, involving educational institutions, citizens and local governments. In addition, it is crucial that this integration be extended to the regional level to ensure ecological connectivity, promoting the sustainability of these spaces. By identifying protected areas and its ecosystems, is possible to maintain their integrity over time. One example is SILAPE, which from 2016 to the present has not diminish its size, demonstrating the effectiveness of its management and conservation.

Protected areas should be conceived not only at the local level, but also through regional synergies that promote ecological corridors for the mobility of large mammals and the maintenance of their habitats. This perspective allows not only the conservation of local biodiversity, but also the provision of ecosystem goods and services on a regional scale, benefiting a broader scope by promoting ecological connectivity and facilitating the consolidation of biological corridors.

It is very important to have technical studies in coordination with universities, validated by entities such as the Humboldt Institute and the Regional Autonomous Corporations (CAR). These studies provide solid basis for taking advantage of the formulation and modification of land-use plans to include conservation projects such as urban protected areas (APU) and SILAPE. This guarantees the conservation of ecosystems and facilitates the availability of tools and resources for their management in the medium and long term.

The municipality is currently making progress in formulating its biodiversity policy, whose primary objective is to enhance natural resources through restoration, preservation and sustainable use measures. This policy is framed in a 12-year work plan, which guarantees its continuity and sustainability through different municipal administrations. Long-term planning makes it possible to implement coherent and sustainable measures, contributing to the conservation and improvement of local biodiversity.

The construction of the SILAPE Management Plan within the framework of the INTERLACE project guarantees the protection of biodiversity and the ecological structure of Envigado, and becomes a crucial tool designed to provide a solid and effective management framework for the administration of these areas. This plan is important because it constitutes the technical underpinning of the next Land Use Plan (POT), establishing clear and forceful guidelines for effective conservation.

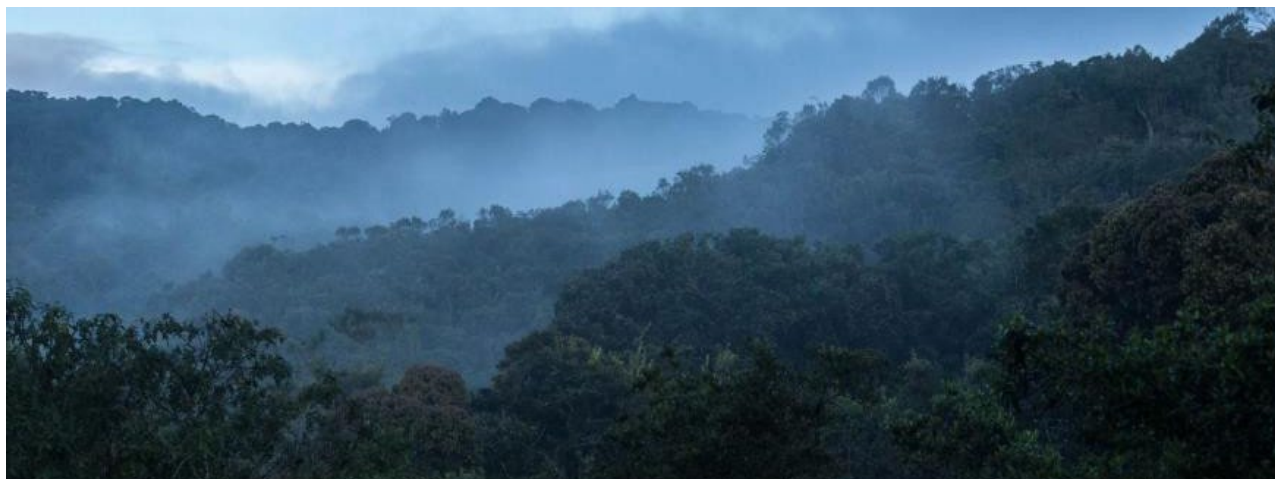


Figure 8. Bosque de Niebla -SILAPE.

## 2.2 Urban Protected Areas (Parque Lineal Ambiental La Heliodora, Humedal El Trianón and Cerro Tutelar)



Figure 9. La Heliodora Environmental Linear Park. Photo: Municipality of Envigado

The Urban Wetland Protected Area (UPA) El Trianón - La Heliodora is located in the urban area of Envigado. This protected area has approximately 23 hectares including the Urban Recreational Area La Heliodora - El Trianón. The landscape and strategic ecosystems maintain their function despite modifications in their structure and composition and have a significant potential for recovery. The associated natural and cultural values are made available to the population for restoration, sustainable use, knowledge and enjoyment. The recreational area El Trianón-La Heliodora is a key area for the city; in addition to being a temperature regulating space and carbon dioxide reservoir, it is a habitat for endemic species of flora and fauna, and an orchideorama, a site that contains an important collection of orchids, such as La Restrepia (*Restrepia antennifera* an endemic specie). In addition, a declaration process is currently ongoing with the Metropolitan Area of the Aburrá Valley for the expansion of this area, which will include Cerro Tutelar, adding an additional 180 hectares to the UPA.

With the declaration of the ARU Humedal El Trianón - La Heliodora, there are now seven Protected Areas in an urban context and one in the process of being declared. These efforts by the community, the Metropolitan Area of the Aburrá Valley and the Metropolitan System of Protected Areas - SIMAP - seek to guarantee the conservation of biological diversity, the supply of ecosystem goods and services, and strengthen the socio-cultural values associated with these places.



Figure 10. Orquideorama Parque Lineal La Heliodora.

### 2.2.1 Benefits of this SbN

Protected natural areas address climate change mitigation and adaptation challenges, along with health and human well-being issues. These areas favor people reconnection with nature and promote local community ownership of natural environment, biodiversity and environmental goods and services. Simultaneously, they are a strategy to minimize environmental degradation and biodiversity loss, providing direct benefits for the fauna and flora that persist in urban environments. In addition, these spaces provide ecosystem services that mitigate the negative effects of highly dense urban environments, such as high temperatures. In highly urbanized environments protected areas are a valuable recreational space that influences the adoption of an active lifestyle with direct consequences of peoples well-being and life quality.

### 2.2.2 Considerations and lessons learned

The effective development of urban protected areas depends largely on the active involvement of stakeholders and citizen participation. This collaboration encourages local governments to manage areas that influence the life conditions of urban dwellers. The local experience with ECOHUMEDALES ONG, managers and promoters of the conservation of the El Trianón Wetland, has shown that, with significant community representation, the management processes of these areas are more efficient. Therefore, the importance of encouraging citizen participation is recognized as a key element for sustainability of urban protected areas.

It is a challenge to achieve the active and conscious participation of the diverse stakeholders in the decision-making process regarding the environmental management of the territory, and its necessary to use mechanisms that generate social activation and dynamic participation. This can be achieved through the organization of interactive socialization fairs, field trips and continuous contact between the community and governmental entities. These activities allow citizens to take ownership of the process and actively participate in prioritizing relevant ecosystems that can be protected, conserved and managed.

It is essential that the protection figures for these high value ecological areas is recognized by regional and national territorial authorities, such as the Metropolitan Area of Valle del Cauca de Aburrá (ÁMVA) and Corantioquia. This action guarantees the official recognition and proper management of these vital spaces for the environmental balance and quality of urban life. In addition, it is relevant to highlight that there are an additional 1.8 million square meters pending approval by ÁMVA, to be included as another green area and strengthen the network of urban protected areas in the region.

Addressing the continuity of urban protected areas represents a significant challenge, especially in the context of changes in local governments. To minimize this situation, it is recommended to anchor these strategies in municipal plans, such as the Municipal Environmental Management System (SIGAM), biodiversity plans and those related to the protected area. This ensures at least 12 years of continuity and management, which is crucial to demonstrate results, since ecosystem impacts are manifested over time and not immediately.

### Box 1. Data on La Heliodora Environmental Linear Park, El Trianon Wetland

- The APU Humedal El Trianón - La Heliodora has 116 tree species, 125 shrub species and 61 herbaceous species.
- In the case of fauna, 7 species of mammals, 7 species of amphibians and reptiles, and 70 species of birds have been recorded in this area.
- Its conservation targets are: The riparian forest, the water resource (Wetland el Trianon, streams and drainages), *Equisetum giganteum* (Horsetail), *Ortalis columbiana* (Guacharaca), *Laterallus albigularis* (Polla de Agua), and the biophony.
- Its objects of cultural conservation are: Local knowledge, and practices and values about nature.
- According to studies on its trees, this APU captures more than 491 tons of carbon.

## 2.3 Strengthening social appropriation of the Ayurá water corridor



Figure 11. Guardianes de la Ayura strategy.

La Ayurá Creek in Envigado stands out for its importance as a natural, cultural and symbolic resource. The municipality considers the creek as a structuring axis of the urban area due to its natural characteristics and its historical and cultural value. Its watershed covers approximately 50% of the municipality. The creek originates in the rural zone and flows into the urban zone, covering 11.8 kilometers. This route not only serves as a biodiversity corridor for birds, mammals, and insects, but also as a recreational space for the inhabitants where they can walk, ride bicycles, and engage in many physical activities. It also contributes to the regulation of the temperature and provides numerous ecosystem services. In recent years, Envigado has experienced significant population growth, reaching a population of close to 248,000 inhabitants. This growth has diluted part of its history, especially after the decision to channel the creek in the 1980s, which has led to La Ayurá creek fading from the collective memory of the people to counteract this phenomenon, in the 1990s renaturalization processes were initiated around the creek, planting tree, shrubs and herbaceous species to create a green corridor.

Recognizing the urgent need to revalue La Ayurá stream and restore its natural, cultural and symbolic importance, the municipality of Envigado, within the framework of the INTERLACE project, proposed the establishment of this water corridor as a SbN. Through this project, various technical activities were implemented and involved in governance and outreach processes, such as:

- **Adoption of the Mesa de la Yurá:** A water governance table was installed with the participation of representatives of the municipal government and members of the community in order to promote and develop actions that consolidate the recognition of the La Ayurá stream as a component of natural and cultural heritage of high value for the municipality. This instrument joins efforts and takes advantage of the expertise of its members to approach the Ayurá Creek from multiple perspectives, implementing environmental education activities in schools near the creek, and promoting artistic and cultural activities.
- **Guardians of the Ayurá:** This is an environmental education strategy implemented since 2022, which has involved the educational community in environmental education processes, in an experimental manner, in 6 educational institutions near the La Ayurá stream. Through workshops on cartography, hydrology, connectivity, visits to protected areas and site visits students develop a deep understanding of the importance of water resources.
- **Environmental Booklet "Ayurá in Stories and Drawings":** Is a booklet of myths and legends written by 30 fifth grade students, who created micro-stories highlighting the natural characteristics of the ravine and its cultural, historical and symbolic significance. The best stories were published in an environmental booklet socialized in 1,000 copies delivered to the educational communities.



Figure 12. Launching of the environmental booklet "Ayurá in stories and drawings" within the framework of the INTERLACE project.

- **Art for appropriation:** A strategy for territorial appropriation focused on the protection of Envigado's strategic natural ecosystems. Actions focused on urban art and are developed with local artists in order to highlight the beauty and importance of wildlife and biodiversity of the territory. Through the development of murals around places of high environmental importance nature is brought to people. With INTERLACE project, a 100 square meter mural was artistically intervened representing the historical and natural importance of the creek.





Figure 13. **AYURÁ PATRIMONIAL MURAL** 100 m2 made within the framework of the INTERLACE project with the objective of highlighting the symbolic, cultural and biological characteristics of the Ayurá stream in the municipality of Envigado.

- **Minecraft:** Development of workshops using the Minecraft video game for students to learn about, plan and design NbS to manage the territory in a sustainable manner in harmony with the water resource.
- **"My River, My City and Me" Contest:** Since 2022, children and young people from the territory participate in this contest, in which they compete with drawings that reflect the natural and cultural attributes of the Ayurá Creek as an strategy for environmental sensibilization.



Figure 14. Drawing made by a 9 year old child in the year 2022 in the contest "My River, My City and Me".

- **Biotours:** Territorial tours focused on highlighting, socializing and awareness raising of Envigado's natural ecosystems, biodiversity, wildlife and water resources.



Figure 15. **Biotours with the community**, SbN dissemination strategy proposed by the INTERLACE project.

### 2.3.1 Benefits of this NbS

The actions that have been developed within the framework of the appropriation of the Ayurá water corridor by the community and the knowledge of its historical and cultural process can be classified as a NbS that integrates biodiversity conservation and community participation. The benefits associated with these actions include the promotion of sustainable ecosystem management, the social appropriation of biodiversity knowledge, and the strengthening of the cultural and symbolic connection between the population and its natural environment, facilitating the recovery and protection of the water corridor in. Additionally, fostering a culture of nature conservation among children living in the urban area of Envigado can have an impact on the care of the natural environment, which promotes healthy recreation and wellbeing of the young people involved and their immediate family environment.

### 2.3.2 Considerations and lessons learned

The recognition of the Ayurá stream as a structuring axis of Envigado with a holistic vision, allows to understand the importance of caring for the water body with actions that not only include the management of natural resources, but also cultural aspects such as stories, myths and legends related to the creek through environmental education, art and recreation to strengthen the social and historical aspects.

It is important to involve both the public and private sectors and the community in environmental issues to generate comprehensive actions with diverse approaches and visions that enrich the final result. A key element in the process of the La Ayurá water corridor to highlight is the intersectoral and interdisciplinary work (involves multiple instances such as the Secretariat of Environment, the Secretariat of Culture, teachers and history professors), which facilitates having an integral perspective of the water resource. However, it is worth noting that it is important to include actors such as the Administrative Department of

Planning, the Secretariat of Risk Management and the Secretariat of Public Works, in order to achieve a complete vision of the stream in the municipality.

The Quebrada La Ayurá has opened new perspectives of knowledge in the municipality of Envigado, in which young people and children participate with direct actions in the creek, such as artistic activities and innovative environmental learning strategies such as the Minecraft video game.

### Box 2. Data on actions to strengthen social ownership of the La Ayurá Water Corridor

- More than 600 Guardianes de La Ayurá children impacted since 2022.
- 9 municipal educational institutions involved.
- More than 80 children participated in the contest "My river, my city and me" with their drawings and poems. More than 6,000 people participated in the process of selecting the winners through social networks.
- More than 300 people were impacted in 15 territory tours, outdoor activities and hikes along the Ayurá creek.
- More than 150 children impacted with the Minecraft game workshop and 20 teachers with wonderful ideas captured in the game and learning about SbN.
- More than 1,000 copies of the environmental booklet "Ayurá in stories and drawings" were delivered to libraries and education centers in the municipality.

## 2.4 Renaturalization program: Envigado Blossoms



Figure 16. Municipal Nursery of the municipality of Envigado.

The municipality of Envigado has been developing the Envigado Florece program for more than 25 years. This program, which began in 1995 under the name "Adopt Nature", can now be considered an urban NbS that seeks to reduce the heat island effect, improve urban biodiversity, ecological connectivity, and public ornamentation, and contribute to the quality of life of city dwellers. The renaturation of spaces (that

are now dominated by built-up land) not only contributes to mitigating the effects of urban development on the environment, such as habitat loss and pollution, but also provides tangible benefits for the physical and mental health of people at the neighborhood level.

Green areas in cities can maintain biodiversity, absorb CO2 and contribute to improving people's wellbeing. The latter is achieved through the enjoyment of direct and indirect benefits that these areas provide to humans. To measure the impact of urban green areas, factors such as social appropriation, perception of benefit and participation are significant. The Envigado Florece program is a strategy with a high level of citizen participation and acceptance. In addition to physical implementations such as planting and maintenance of gardens, and changing from hard to soft ground, the program offers many activities such as workshops and artistic activities that contribute to social appropriation and cohesion.

Some of the actions of this NbS are:

- Delivery of free planting material and agricultural inputs.
- Transformation of hard zones into soft zones.
- Improvement of green public spaces through the planting of native and ornamental plant species.
- Educational and community awareness programs through face-to-face and experiential workshops.
- Competitions that encourage ownership of the greening of the municipality.



Figure 17. Recognition to Junta de Acción Comunal in "Envigado Florece" contest. Envigado Florece Contest: This contest promotes gardening in public and private spaces, offering symbolic recognition to participants passionate about gardening and renaturalization.

These implemented green areas are managed in a participatory manner so that they will last over time, since the communities oversee their maintenance and conservation under the concept of co-responsibility.

Planting gardens in public areas improves the permeability of soils by allowing rainwater to infiltrate more easily, reducing surface runoff and reducing the risk of flooding. In addition, these gardens act as carbon sinks, helping to mitigate the effects of climate change by absorbing CO<sub>2</sub>. They also help regulate local temperature, improve air quality and provide habitats for urban biodiversity.



Figure 18. Envigada Blossoms Program.

Within the INTERLACE project, a monitoring strategy was co-designed for the Envigado Florece program, since, despite several years of implementation, there was no strategy to quantify its impact. This monitoring is planned through the measurement of observable and quantifiable indicators to evaluate the progress and impact of the Envigado Florece program. Together with the Humboldt Institute, and the participation of key stakeholders from the Envigado Environmental Secretariat and the community, a monitoring strategy was developed that encompasses three components, according to the challenges addressed by the program: social, climate and biodiversity. Each component has one or more indicators, formulated based on guiding questions (see Table below).

Component	Guiding question	Indicators
<b>Social</b>	<p>How does the Envigado Florece program contribute to the increase of urban green areas?</p> <p>How do the participatory activities of the Envigado Blossoms Program contribute to social cohesion, social participation and ownership, and human well-being?</p>	<p>Green area surface per inhabitant per zone (modified ICAU).</p> <p>Participation of different social groups, generation of links between actors, willingness to participate, perception of change in security, perception of connection with nature, among others.</p>

<p><b>Biodiversity</b></p>	<p>Are urban green areas associated with bird diversity in the municipality of Envigado?</p> <p>Are the plants planted by the program associated with increased insect biodiversity in the gardens of the programme Envigado Florece?</p>	<p>Change in bird diversity associated with urban green spaces.</p> <p>Change in the biodiversity of insects associated with the Program's gardens.</p>
<p><b>Climatic</b></p>	<p>The change from hard to soft flooring and the implementation of new green areas influences the reduction of temperature and the climate comfort?</p>	<p>Universal Thermal Climate Index (UTCI)</p>



Figure 19. Meeting under the framework of the INTERLACE project co-design of monitoring strategy for the Envigada Florece program.

### 2.4.1 Benefits of this NbS

This initiative addresses challenges such as climate change adaptation, and its main objectives is to reduce urban heat islands. It also addresses the challenge of human health and well-being and environmental degradation, biodiversity loss, ecological connectivity and low plant diversity to attract native urban fauna. This program also emphasizes the importance of community ownership to ensure the continuity of the processes. To this end, it works with a co-responsibility approach that directly benefits the participating citizens and the Secretariat of the Environment, to the extent that the participants support the maintenance of the garden and enjoying its benefits. In relation to the increase of urban biodiversity, the program delivers plant material to citizens and plans to incorporate more native species over time.

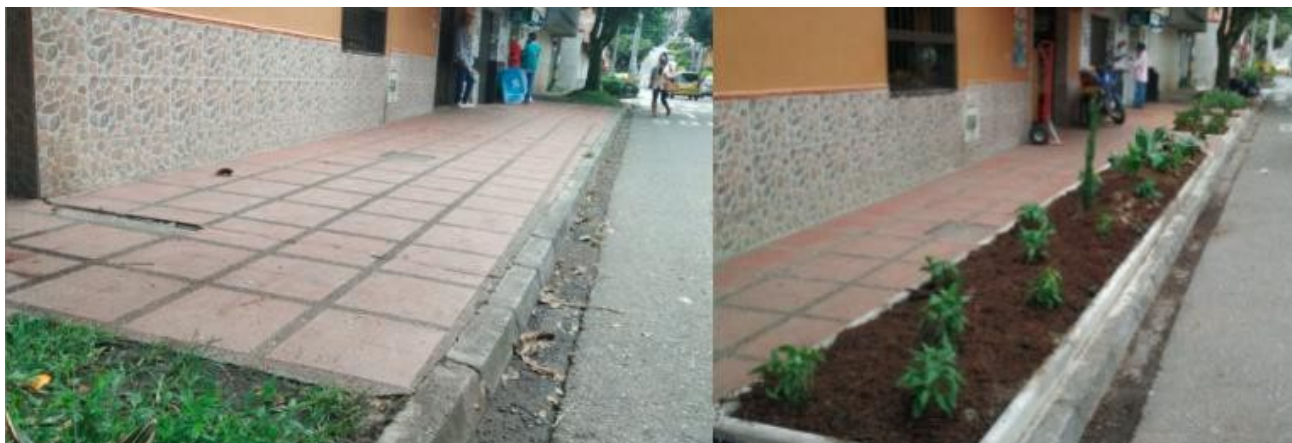


Figure 20. Change from hard to soft soil under the Envigado Florece strategy.

### 2.4.2 Considerations and lessons learned

Through the implementation of the designed monitoring strategy, the approaches addressed by the program, framed in biodiversity, community ownership and thermal comfort, will allow the municipality of Envigado to provide solid data on the benefits of in the urban area. This approach is fundamental, as data is crucial to demonstrate the effectiveness of NbS.

Within the program, one of the most important activities to encourage planting and improvement of gardens in the municipality of Envigado is the donation of plants by the Secretary of the Environment. However, so far there is very little diversity in the species delivered. Therefore, a greater diversification is proposed to increase biodiversity to attract pollinators and other fauna species.

Temperature simulation models are valuable tools for designers and urban planners, used to forecast and evaluate the impact of urban designs and solutions with specific variables. In the context of NbS implementation in urban areas, simulations are particularly useful. TENCALIA performed a modeling with ENVIMet 5.0 to analyze the heat distribution in four neighborhoods in Envigado (previously registered as having the highest thermal sensations in a study conducted by ÁMVA), to identify hot spots and evaluate the effectiveness of urban interventions with NbS. Based on these data, it will be possible to prioritize the places to implement the monitoring of the effectiveness of Envigado Florece Program; specifically the change from hard to soft ground and the creation of urban gardens.

### Box 3. Facts about the Envigado Florece Program

- Between 2020 and 2024, 189,259 plants were propagated in the municipality's nurseries.
- Between 2020 and 2024, more than 127,125 plants were delivered to the community.
- In the years 2022- 2023, 270 gardens participated in the Envigado Florece contest.
- In the years 2022- 2023, 1870 new gardens in urban public areas were created.
- In the years 2022- 2023, 816 gardening workshops were held with an attendance of approximately 16,320 people.
- In the years 2022- 2023, more than 2,000 m2 of reclaimed hard floors were transformed into soft floors. More than 600 Guardianes de La Ayurá children impacted since 2022.





### 3. Final considerations and other lessons learned

- It is essential for a municipality to collaborate with local and regional stakeholders to implement nature-based solutions, such as protected areas and water corridors. This collaboration leverages the knowledge and resources of various entities, ensuring more effective planning and management. It also fosters community participation, increasing awareness and commitment to conservation. Working together facilitates networking to strengthen ecological connectivity and biodiversity corridors at a scale that transcends political-administrative boundaries.
- Regional articulation is key to ensure the conservation of protected areas, which is why the Secretariat of Environment and Agricultural Development has established strategic alliances for the consolidation and strengthening of the Departmental System of Protected Areas; to share its experience with other administrations that carry out actions and to consolidate its own system and promote its articulation with neighboring municipalities. In this sense, the **"Mesa por la Conservación del Sur"** was formed by the municipalities of: Envigado, Sabaneta, Caldas, La Estrella and Itagüí, and has made significant progress in recent years in three main components: (i) The data collection, analysis and development of regional products; (ii) the exchange of knowledge and experience to strengthen local capacities in ecosystem conservation. (iii) Inter-institutional articulation for the development of projects and initiatives for wildlife conservation and resource management for the five municipalities and whose main objective is to implement actions for the conservation of the feline.
- Envigado is recognized as a national reference in conservation. The work done with prestigious institutions on the field such as: Alexander Von Humboldt Institute, National Natural Parks, SIDAP Antioquia (Departmental System of Protected Areas), Corantioquia (Regional Autonomous Corporation of Central Antioquia), Metropolitan Area of the Aburrá Valley, EPM (Public Enterprises of Medellín), National University, University of Antioquia, Botanical Garden, CES University; among others, supports the advances made in the territory.
- Finally, community participation has been a key subject when developing NbS. Environmental leaders, educational institutions and citizens have been integrated into nature conservation strategies, and activities (walks to recognize the territory, celebration of environmental days, forums on conservation issues, environmental education and citizen science processes).



Figure 21. **Hidden Nature**: Participatory monitoring strategy in SILAPE that links different communities present in the territory in this case I.E Manuel Ríos Llanos. This process allowed students to learn about wildlife monitoring, from the installation of the cameras to the collection and analysis of information.



Figure 22. e: Territory tour with students from the La Leticia School under the SbN dissemination strategy in the framework of the INTERLACE project to promote the social appropriation of knowledge about water resources among children from educational institutions in the municipality of Envigado. The focus is on La Ayurá stream and the Local System of Protected Areas of Envigado.



INTERLACE is a four year project that will empower and equip European and Latin American cities to restore urban ecosystems, resulting in more liveable, resilient and inclusive cities that benefit people and nature.

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## Project Partners



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 869324.

