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AMAZON BOTANICAL GARDEN: AN ETHNOGRAPHIC ECOTOURISM PROJECT IN THE COLOMBIAN AMAZON BASIN

RESUME

The Yucuna Botanical Garden, located in the Colombian Amazon basin, is a project aimed at preserving the unique biodiversity of the region and promoting the well-being of the Yucuna indigenous community through conservation strategies, environmental education and sustainable development. This 10,000 m² space houses a significant collection of more than 500 plant species, including endemic orchids and Amazonian trees, which are fundamental both for ecological conservation and for the cultural and economic sustenance of the local community.

The Yucuna Botanical Garden is a collaborative effort between researchers, conservationists and members of the Yucuna community, which seeks to address contemporary environmental challenges, particularly the impacts of climate change. The project is structured into various areas of action that include the conservation of endangered species, the restoration of ecosystems, educational programs and the development of community capacities.

One of the main objectives of the garden is the in situ and ex situ conservation of endangered species, such as *Cattleya warneri* and *Alstroemeria psittacina*, through the creation of specialized micro-habitats and nurseries that facilitate breeding programs. These activities are complemented by reforestation initiatives that seek to restore 50 hectares of degraded lands, using native species that improve the biodiversity and ecological resilience of the area.

The project places a strong emphasis on environmental education, implementing more than 200 annual workshops that educate the local community and visitors about the importance of biodiversity conservation and sustainable resource management practices. Additionally, community members are trained as environmental guides, which not only encourages local employment but also ensures the transmission of traditional and scientific knowledge to visitors.

In collaboration with academic institutions, the garden carries out research on the adaptation of species to climate change and the most effective methods for conserving biodiversity. This research component is vital for the creation of evidence-based strategies that can be replicated in other regions of the Amazon and beyond.

The project is also deeply rooted in community participation, allowing local residents to actively participate in the management and decisions of the garden. Microbusiness projects are promoted and programs that use garden resources sustainably, such as beekeeping and agroforestry, are implemented, which provide additional income to local families.

The Yucuna Botanical Garden is financed through a combination of international grants, government funds, carbon offset programs, and generating its own income through ecotourism and the sale of derived products. This diversified financing strategy ensures the long-term sustainability of the project and its ability to adapt to the changing needs of the community and environment.

The Yucuna Botanical Garden not only preserves the rich biodiversity of the Colombian Amazon, but also serves as a model for how environmental conservation can be integrated with community and educational development. This holistic and sustainable approach promotes a harmonious coexistence between humans and their natural environment, ensuring that both biodiversity and local culture thrive for future generations.

NEED ADDRESSED

The Yucuna Botanical Garden, spread over 10,000 m² in the Colombian Amazon basin, faces significant challenges due to climate change, which threaten its unique biodiversity and the subsistence of the 500 families of the Yucuna indigenous community who depend on this ecosystem for their livelihood. and culture. Climate change is manifested in this region through an increase in the variability of precipitation and an intensification of dry and wet seasons. Recent studies indicate that the temperature in the Amazon region has increased on average 1.5°C in recent decades, which has led to changes in the flowering and fruiting patterns of native species.



Additionally, variability in rainfall has resulted in longer periods of drought, interrupted by intense rains that cause severe flooding. These climatic extremes put the survival of endemic plants at risk and negatively affect the availability of natural resources for the Yucuna community. For example, the Moriche palm (*Mauritia flexuosa*), crucial to the local economy due to its use in housing construction and food production, has shown a decrease in its reproduction and growth rate due to water and thermal stress.

The decline in the availability of natural resources, exacerbated by climate change, has led to an increase in food insecurity. 60% of families report a reduction in their ability to obtain traditional foods, such as fruits and fish, which are essential to their diet and culture. Additionally, climate change threatens to alter the ecosystem services that the botanical garden provides, such as air purification, local climate regulation, and protection against soil erosion.

Faced with these challenges, the urgent need to implement adaptation and mitigation strategies in the botanical garden to preserve its biodiversity and ensure the continuity of the benefits it provides to the Yucuna community becomes evident. This need is based both on the ecological vulnerability of the area and on the socioeconomic dependence of the local community on the resources that the

garden offers. A proactive approach to managing and strengthening the garden's climate resilience will not only contribute to the conservation of key species and the protection of critical habitats, but will also improve the quality of life and food security of Yucuna indigenous families.

JUSTIFICATION

The Yucuna Botanical Garden, crucial to the conservation of biodiversity in the Colombian Amazon basin, faces significant challenges due to climate change that threatens its ability to function as a bastion of biological diversity and a vital resource for the Yucuna indigenous community. With at least 500 documented species of flora, some of which are endemic and others have recognized medicinal or food uses, this garden is not only a haven of biodiversity but also a center of ancestral knowledge and culture.

The region has experienced a 1.5°C increase in average temperature in recent decades, significantly altering the life cycles of many botanical species. The phenology of key plants, which synchronizes events such as flowering and fruiting with the seasons, has become unbalanced, leading to a mismatch between the availability of food resources and the needs of local fauna, including numerous pollinators and frugivores that are essential for seed dispersal and cross-pollination. For example, the phenology of the species *Inga edulis*, vital for its nutritious fruit and its role in soil regeneration, shows a tendency towards early flowering that does not coincide with the presence of its usual pollinators.



Furthermore, alterations in the rainfall regime have led to more intense and prolonged periods of drought, followed by shorter but extremely intense rainy seasons, exacerbating the risk of soil erosion and nutrient loss. These extreme conditions compromise the health of the soil and the availability of water, essential for the maintenance of plant life and, therefore, for all the biodiversity dependent on this ecosystem.

The justification for strengthening the resilience of the Yucuna Botanical Garden in the face of climate change is multiple: first, protecting the botanical wealth it has, including rare and threatened species. Second, ensure that it continues to serve as an essential resource for environmental education, scientific research and conservation. Third, ensure that the Yucuna community maintains access to traditional resources that are fundamental not only for their physical subsistence but also for the preservation of their cultural heritage.

This garden acts as a natural laboratory where the impacts of climate change can be studied and adaptation and mitigation strategies that could be applied in other similar contexts can be tested. Investing in your resilience is also an investment in scientific and practical knowledge that can offer solutions to some of the most pressing problems facing our society in terms of environmental sustainability and adaptation to climate change.



Therefore, the need to implement a comprehensive plan that not only addresses the direct impacts of climate change, but also strengthens local infrastructure and capacities to manage these changes, is evident and urgent. This approach will not only preserve the garden as a key resource for future generations but will also strengthen the Yucuna community's ability to adapt to an ever-changing environment, ensuring its well-being and that of its ecosystem in the long term.

PROJECT OBJECTIVES

The fundamental mission of the Yucuna Botanical Garden project is to strengthen the resilience of this vital ecosystem in the face of the growing challenges of climate change, thus ensuring its conservation and the sustainability of the resources it provides to the Yucuna indigenous community. The objectives are designed to address both the environmental and social and cultural aspects that this garden represents. The general objective and specific

objectives of the project are detailed below:



General objective:

Strengthen the resilience of the Yucuna Botanical Garden in the face of climate change to conserve its biodiversity and guarantee the sustainability of the natural resources that support the Yucuna indigenous community.

Specific objectives:

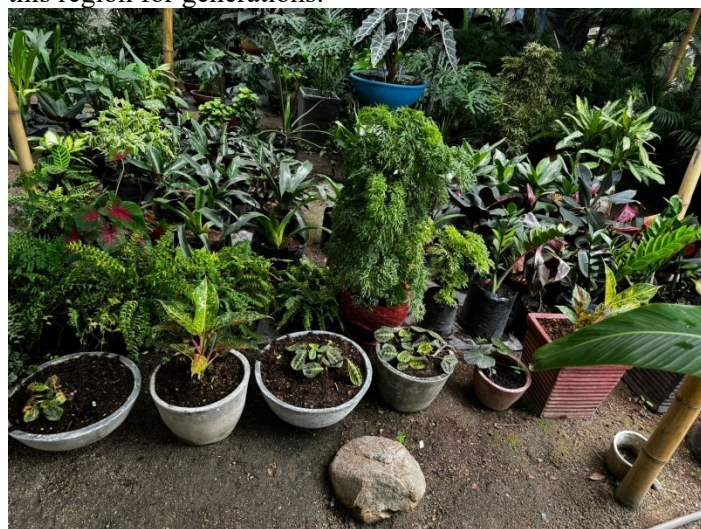
- Improve the garden's infrastructure for the conservation of endemic and threatened species.
- Implement efficient irrigation systems that ensure water supply during periods of drought, benefiting at least 200 species that show signs of water stress.
- Establish specialized nurseries for the propagation of species at risk, with the aim of reintroducing at least 1000 plants a year into their natural habitat within the garden.
- Develop education and training programs on conservation practices and adaptation to climate change for the Yucuna community.
- Organize 50 annual workshops that reach at least 300 community members, focused on resilient farming techniques, sustainable resource use, and environmental monitoring.
- Create educational materials in indigenous languages that promote the importance of biodiversity and adaptation strategies to climate change.
- Increase scientific research to monitor the impacts of climate change on garden biodiversity.
- Establish collaborations with at least 5 academic institutions to carry out research that evaluates the adaptability of species to changes in temperature and precipitation.

- Publish at least 2 studies annually that contribute to global knowledge on climate resilience in tropical ecosystems.
- Encourage community participation in the management and conservation of the garden.
- Implement a 'garden guardians' program, with 40 active community participants, who will help with maintenance tasks, species monitoring and educational guides.
- Develop a system of incentives for families who actively participate in conservation and education activities, providing resources and tools that facilitate their own sustainability practices.
- Establish a monitoring and evaluation system to measure the effectiveness of the adaptation strategies implemented.
- Install weather stations and monitoring cameras at strategic points within the garden to collect continuous data on climatic factors and biological activity.

engagement. By achieving these objectives, the Yucuna Botanical Garden will not only be strengthened in the face of climatic adversities, but will also consolidate itself as a model of environmental management and sustainability for other communities and ecosystems in the Amazon region.

BACKGROUND AND DESCRIPTION OF THE CURRENT SITUATION

The Yucuna Botanical Garden, located in the vast and biodiverse Colombian Amazon basin, is a center for the conservation and study of the typical flora of this equatorial region. At approximately 10,000 m², the garden is home to more than 500 plant species, many of which are endemic and play critical roles in both its ecosystem and the culture of the Yucuna indigenous community, which has inhabited this region for generations.



Background

Established in 1998, the garden was initially conceived as an effort to preserve local species that were beginning to be threatened by advancing deforestation and agricultural and mining exploitation. Over time, it has evolved into a more robust complex, incorporating environmental education programs, scientific research and sustainable conservation practices. The interaction between the Yucuna community and the garden has allowed not only the preservation of local flora but also the transmission of traditional knowledge associated with the medicinal and nutritional use of plants.

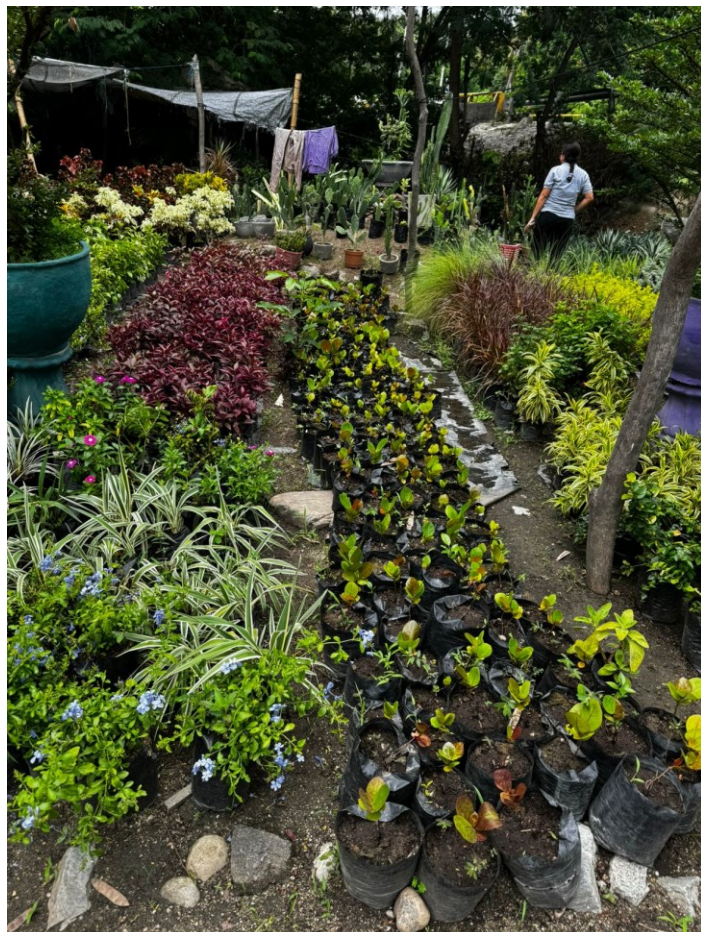
Current situation

Currently, the Yucuna Botanical Garden faces unprecedented challenges due to climate change. Data collected in the last decade indicate an increase in the region's average temperature of up to 1.5°C, while rainfall shows a trend towards more erratic patterns with longer periods of drought alternating with short, intense rainy seasons. This change in climate has had palpable impacts on the phenology of plants: alterations in flowering and fruiting times are evident, which affects the availability of food for fauna and compromises pollination processes.



Evaluate project progress semi-annually, adjusting strategies as necessary to maximize ecosystem resilience. These goals reflect a comprehensive and multifaceted approach to addressing climate resilience, combining direct conservation with education, research, and community

Additionally, recent studies have documented an increase in the incidence of diseases and pests that were previously controlled naturally by the region's stable climatic conditions. This has led to greater vulnerability of critical species, such as the "Pink Cedar" (*Cedrela odorata*), whose wood is highly valued both ecologically and economically.



The garden also serves as an indicator of the overall health of the Amazon ecosystem. The reduction in the genetic diversity of certain species, due to the lower frequency of seed dispersal events and habitat loss, points towards a decrease in the ecological resilience of the region. For example, the Aguaje palm (*Mauritia flexuosa*), vital to the ecosystem for its ability to store water and provide food for numerous species, shows signs of stress from lack of water during prolonged months of drought.

APPROACH AND SELECTION OF ALTERNATIVES

This context highlights the urgent need to adopt adaptation and mitigation measures that can counteract the effects of climate change and ensure the survival of the garden and its ecological, educational and cultural functions. Collaboration between the garden's scientists and the Yucuna community is more crucial than ever to develop strategies that allow both flora and fauna to adapt to new climatic conditions, thus guaranteeing the conservation of

this unparalleled natural and cultural heritage.

In the context of climate change and its impact on the biodiversity of the Yucuna Botanical Garden, conservation alternatives are proposed focused on the protection and promotion of particularly vulnerable native species. Among these, several species of orchids and trees representative of the Colombian Amazon stand out, which are not only important from an ecological point of view, but also culturally and scientifically.



Native Orchids of the Colombian Amazon

Cattleya warneri (CR - Critically Endangered)

Conservation Alternative: Establishment of a controlled micro-habitat within the garden that simulates optimal humidity and light conditions, along with assisted reproduction programs to increase its population.

Cattleya loddigesii (EN - Endangered)

Conservation Alternative: Implementation of community education workshops to promote the protection of its habitat, complemented with research on its specific soil and nutrient requirements for its effective cultivation.

Cattleya maxima (VU - Vulnerable)

Conservation Alternative: Development of a germplasm
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exchange program with other botanical gardens to guarantee the genetic diversity and resilience of the species.

Alstroemeria psittacina (CR - Critically Endangered)



Conservation Alternative: Creation of seed banks and protected growing areas within the garden to ensure its long-term survival and study its adaptation to climate change.

Alstroemeria aurea (EN - Endangered)

Conservation Alternative: Promotion of reforestation programs using this species, given its capacity to adapt and grow in different environmental conditions.

Alstroemeria aurantiaca (VU - Vulnerable)

Conservation Alternative: Collaboration with scientific institutions to carry out phenological studies that help better understand the effects of climate change on their life cycles.

Representative Trees of the Amazon

Yarumo (*Cecropia peltata*)

Conservation Alternative: Use of the Yarumo in reforestation programs given its rapid growth and ability to quickly provide cover and food to local fauna.

Coctinu (*Miconia amazonica*)

Conservation Alternative: Continuous monitoring and establishment of special conservation areas within the garden, given its importance as an endemic species and its vulnerability to climate change.

Monteverde (*Monteverdia macrocarpa*)

Conservation Alternative: Research in collaboration with universities to understand their specific conservation needs and response to environmental stress.

Caimito (*Pouteria caimito*)

Conservation Alternative: Environmental education programs to promote its cultivation and sustainable use among local communities, taking advantage of its nutritional and economic value.

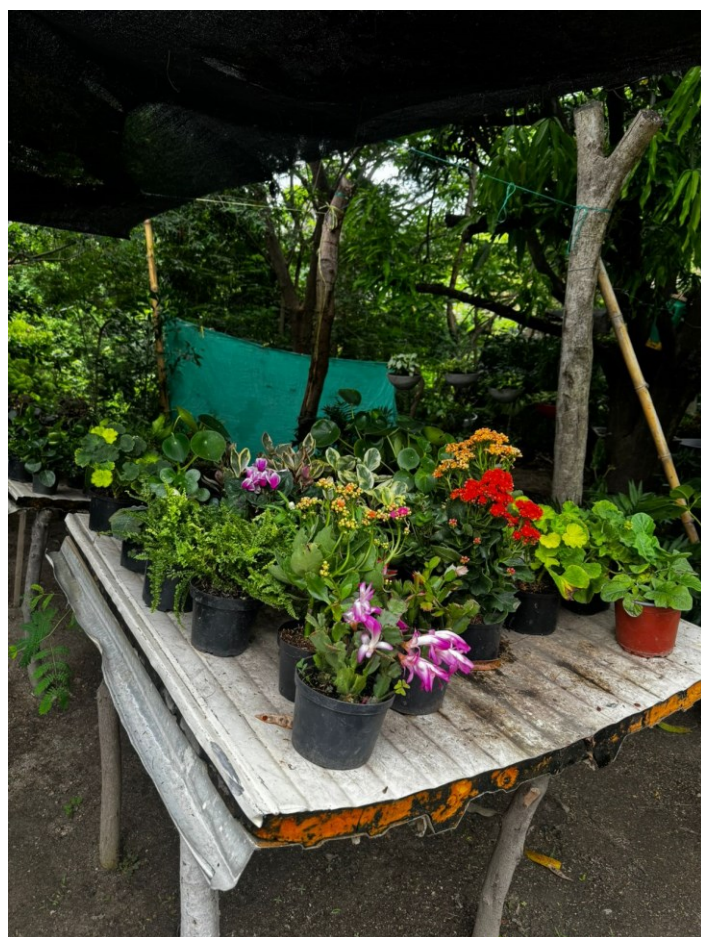
Amazonian Elderberry (*Salix humboldtiana*)

Conservation Alternative: Propagation and adaptation studies to evaluate its resistance capacity to diseases and pests under climate change scenarios.

Each of these alternatives not only seeks to preserve the species in question, but also to enhance the garden as an educational, scientific and community resource, focusing efforts towards sustainable and conscious management of the natural heritage of the Amazon.

LOCATION

The Yucuna Botanical Garden is located in the Colombian Amazon basin, specifically in the department of Amazonas, an area recognized for its extreme biodiversity and ecological complexity. This location is not only strategic for the conservation of a wide range of endemic and endangered species, but is also fundamental for the study of the impacts of climate change on tropical ecosystems.



Geographic Coordinates and Climate

The garden is located at approximately 2° South and 69° West, in a region that typically experiences a humid equatorial climate. Average annual temperatures range between 26°C and 28°C, with relative humidity that rarely falls below 80%. Annual precipitation is high, exceeding 2500 mm, distributed mainly in the rainy season that

extends from December to May. However, precipitation patterns have shown significant variability in recent decades, evidence of climate change at work.



Ecological Importance of Location

The Yucuna Botanical Garden is nestled in a region that is home to more than 10,000 species of plants, many of which are unique to the Amazon. This botanical wealth is complemented by a high diversity of fauna, including numerous species of birds, mammals, reptiles, and a countless number of insects and other invertebrates. The garden's proximity to the Amazon River gives it a crucial role in the conservation of riparian zones, which are vital for water regulation and erosion prevention.

Connections with Local Communities

The garden is located near several Yucuna indigenous communities, whose relationship with the natural environment is intrinsic to their culture and subsistence. This proximity has facilitated collaborative projects that not only seek to conserve natural heritage, but also strengthen the community's cultural heritage through the transmission of traditional knowledge about the use and management of natural resources.

Impact of Climate Change on Location

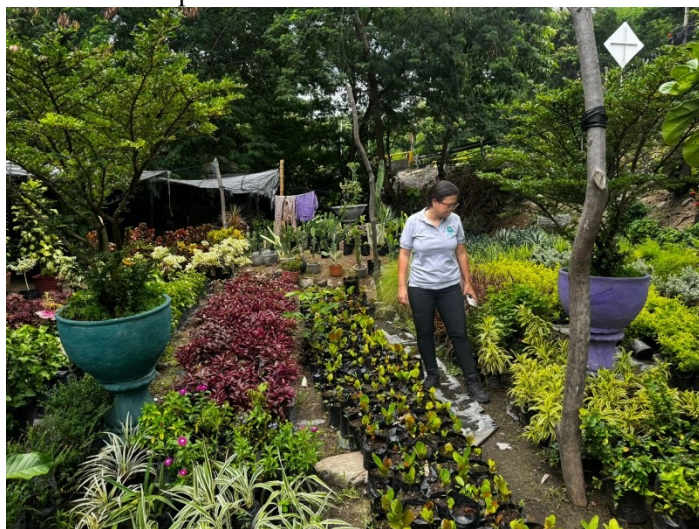
The garden's location in one of the most biodiverse and at the same time most threatened regions in the world places it

on the front line of the impacts of climate change. Increased climate variability has led to changes in rainfall and temperature regimes, affecting the life cycles of plants and animals and altering aquatic and terrestrial ecosystems. These changes impose additional challenges for the conservation and management of the garden, which must continually adapt to new conditions.

Challenges and Opportunities

The location of the Yucuna Botanical Garden offers both challenges and opportunities. Among the challenges is the need to develop infrastructure that can withstand extreme weather conditions and adapt to environmental fluctuations. Opportunities, on the other hand, include the ability to conduct cutting-edge research in conservation and natural resource management, as well as the possibility of acting as a catalyst for sustainable development projects in the region.

The location of the Yucuna Botanical Garden is not only fundamental to its conservation mission, but also positions it as a vital center for environmental research and education, making it a pillar for the global strategy to combat climate change and loss of biodiversity in one of the most critical biomes on the planet.



CITIZEN PARTICIPATION

The Yucuna Botanical Garden, located in the Colombian Amazon basin, focuses on biodiversity conservation and sustainable development, focusing especially on the Yucuna indigenous community, which makes up the main target group of this project. This community is made up of approximately 500 families who intrinsically depend on the local ecosystem for their subsistence and cultural practices.

Demography and Ecological Dependency

The 500 families of the Yucuna community represent a population of around 2,500 individuals distributed in several villages along the Amazon River. The social structure of these communities is typically extended, with a strong emphasis on collectivity and communal work.

Economically, they depend on fishing, hunting, and gathering forest fruits and plants for their daily food, as well as subsistence agriculture, practicing a form of shifting cultivation known as "chagra."



Relationship with the Ecosystem

The relationship of the Yucuna community with its environment is one of profound interdependence. Cultural and spiritual practices are closely linked to the land and its resources. The botanical garden not only serves as a reserve for plants used in traditional medicine and rituals, but also as a space for the transmission of ancestral knowledge to new generations. Species such as the Ceiba (Ceiba pentandra) and the Yagé (Banisteriopsis caapi) have spiritual and medicinal meanings deeply rooted in their culture.

Socioeconomic and Environmental Challenges

Despite its rich cultural heritage and biodiversity, the community faces numerous challenges. Poverty, limited access to basic services such as education and healthcare, and external pressure for natural resources put their traditional way of life at risk. Furthermore, climate change threatens their agricultural practices and the availability of natural resources, exacerbating their vulnerability.

Project Objectives towards the Population

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The Yucuna Botanical Garden project aims not only to protect the environment, but also to improve the quality of life of the Yucuna community. The aim is to integrate the community in the management and operation of the garden, offering training in sustainable agricultural techniques, natural resource management and ecological tourism. This not only helps preserve the ecosystem, but also provides vital skills for economic self-sufficiency.

Expected benefits

With the implementation of this project, it is expected that the Yucuna community will be able to:

- Improve their food security by adopting agricultural practices adapted to climate change.

- Increase your economic resilience through employment opportunities in the garden and related activities as tour guides, flora guardians and environmental educators.

- Strengthen its social and cultural fabric by revaluing its traditional knowledge and promoting its intergenerational transmission.

Integral approach

The project's approach is comprehensive, recognizing that effective conservation and sustainable development can only be achieved through an approach that respects and strengthens local capacities. By focusing on the needs and aspirations of the Yucuna community, the Yucuna Botanical Garden is positioned as a model of natural resource co-management that could be replicated in other regions of the Amazon and beyond.



This project, therefore, not only aims at environmental conservation, but is also a vital tool for community empowerment and sustainable development, ensuring that the Yucuna community can thrive in harmony with their ancestral home in the heart of the Amazon.

PROJECT DESCRIPTION

The Yucuna Botanical Garden project in the Colombian Amazon basin is an integrated effort designed to strengthen

resilience in the face of climate change, conserve biodiversity, and promote education and community participation. With an area of 10,000 m² dedicated to the cultivation and study of native botanical species, the garden acts as a vital center for environmental research and the conservation of natural resources, directly benefiting the 500 families of the Yucuna indigenous community.



Project Objectives and Structure

The project is structured to address both the environmental and socioeconomic needs of the region. Its design includes specific areas for the conservation of endangered species, scientific research areas, and spaces for community education and training. A network of ecological trails allows the observation and study of local flora and fauna without disturbing the natural balance of the ecosystem.

Botanical Collections and Conservation

The garden is home to more than 500 species of plants, including orchids such as *Cattleya warneri* and *Alstroemeria psittacina*, both classified as Critically Endangered (CR). In addition, significant trees such as the Yarumo (*Cecropia peltata*) and the Caimito (*Pouteria caimito*) are preserved, fundamental for the ecological structure and the support of numerous animal species. These collections are essential for research and reproduction programs, which seek not only to preserve but also propagate these species under controlled conditions for their eventual reintroduction into their natural

habitats.

Infrastructure and Technology

To adapt to climate change, the project has implemented efficient irrigation technologies and rainwater harvesting systems, ensuring water supply during increasingly long dry seasons. Additionally, sustainable agriculture and permaculture practices are used to maintain soil health and promote biodiversity.

Community Education and Training

A key component of the project is its focus on education and training. Workshops are offered on agricultural techniques resilient to climate change, sustainable use of resources and biodiversity conservation. These programs are designed to empower the Yucuna community, providing the tools and knowledge necessary to manage their natural resources sustainably.

Research and Collaborations

The garden collaborates with academic institutions and conservation organizations to conduct research on the impacts of climate change on Amazonian biodiversity. These studies not only enrich global knowledge but also inform garden conservation and management practices. Research results are regularly published and conferences and seminars are organized to disseminate the findings.



Community Participation and Benefits

The management of the Yucuna Botanical Garden is inclusive, allowing community members to participate in decision-making through management committees. This ensures that the project is relevant and beneficial to your needs. Additionally, the garden provides direct and indirect employment to many local families, in roles ranging from resource management to visitor guiding.

This project represents a comprehensive model of how biodiversity conservation can be aligned with community development and climate change adaptation, ensuring that

both the ecosystem and the human communities that depend on it can thrive in an uncertain future. With its holistic and collaborative approach, the Yucuna Botanical Garden not only preserves the rich biodiversity of the Amazon but also strengthens the Yucuna community, making it more resilient in the face of emerging environmental challenges.



PHYSICAL PROJECT GOALS

The main objective of the Yucuna Botanical Garden is to strengthen the resilience of the Amazon ecosystem through conservation and education, directly benefiting the Yucuna indigenous community. To achieve these goals, the project has established specific physical goals that are critical to the success and sustainability of the initiative. These goals are quantifiable and designed to have a measurable impact on both conserving biodiversity and improving the quality of life of the local community.

1. Establishment and Improvement of Infrastructure

Construction of 2,000 m² of greenhouses: These spaces will be essential for the propagation of endemic and endangered species, such as *Cattleya warneri* and *Alstroemeria psittacina*. Greenhouses will allow more effective control of the environment, crucial for the success of reproduction and growth of sensitive species.

Development of 3,000 m² of nurseries: These nurseries will support the reproduction of important tree species such as the Yarumo (*Cecropia peltata*) and the Caimito (*Pouteria*

caimito), facilitating reforestation and ecological restoration programs.

2. Restoration and Conservation of Habitats

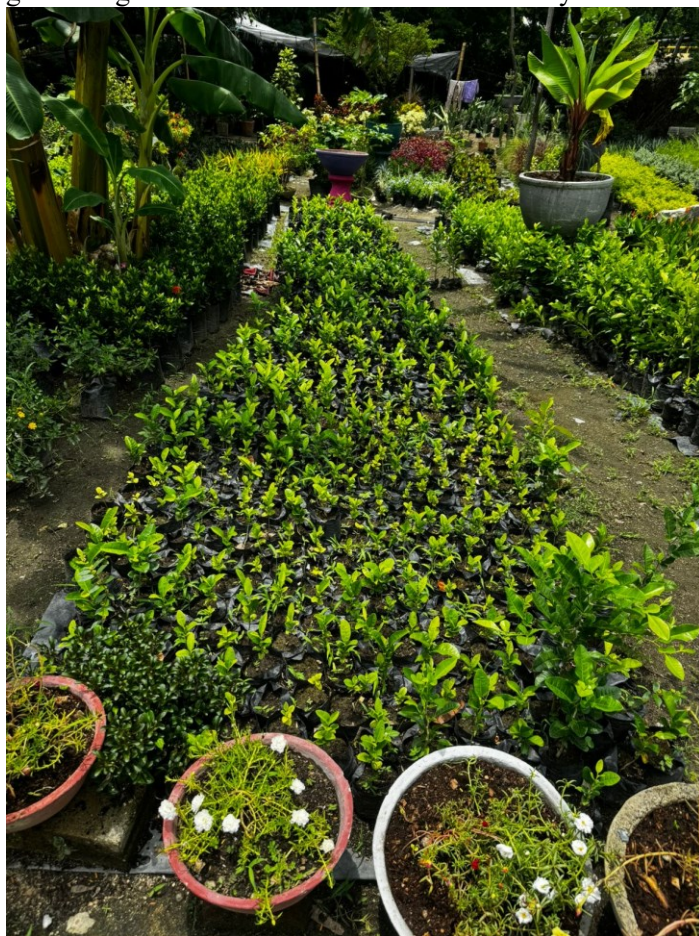
Reforestation of 50 hectares of degraded land: By planting native species, habitat will be restored and ecological connectivity, crucial for the mobility of animal species and seed dispersal, will be improved.

Installation of 100 biological monitoring stations: These stations will facilitate the continuous collection of data on flora and fauna, allowing proactive adjustments in garden management strategies and evaluation of the impact of conservation interventions.

3. Training and Education

Conducting 200 training workshops per year: These workshops will be aimed at members of the Yucuna community, covering topics such as sustainable agriculture techniques, biodiversity conservation, and adaptation to climate change.

Development of a nature guide program: Train 50 community members as guides, who will be able to lead educational visits to the garden, promoting ecotourism and generating additional income for the community.



4. Research and Development

Publication of 5 annual scientific studies: Focused on the adaptability of species to climate change and the

effectiveness of conservation techniques implemented in the garden.

Collaboration with at least 10 international academic and research institutions: Establish alliances for joint research and the exchange of knowledge and technologies in conservation.



5. Sustainability and Community Autonomy

Installation of efficient irrigation systems on 100 hectares: These systems will use rainwater harvesting and drip irrigation technologies to maximize water use efficiency.

Development of a sustainable garden management plan: Include strategies for the long-term management of the garden's natural resources, ensuring its financial and ecological sustainability.

These physical goals not only reflect a commitment to environmental conservation and sustainable development, but are also designed to provide tangible, long-term benefits to the Yucuna community, ensuring that the Yucuna Botanical Garden remains a valuable resource for future generations.

ACTIVITIES AND METHODOLOGY

The Yucuna Botanical Garden project is designed to integrate conservation, education, research and community participation activities, using methodologies that ensure sustainability and effectiveness in the management of the Amazon ecosystem and the strengthening of the local community. The main activities and methodologies used to achieve the project objectives are detailed below.

1. Conservation and Restoration of Species

- Activities:
- Identification and mapping of key species within the garden using GIS (Geographic Information System) techniques to monitor their distribution and conservation status.
- Implementation of ex situ and in situ propagation programs for endangered species, such as the orchids

Cattleya warneri and **Alstroemeria psittacina**, and significant trees such as the *Yarumo (*Cecropia peltata*).

- Reforestation of degraded areas using native species, following an ecological succession plan that imitates natural processes and promotes biodiversity.

- Methodology:

- Use of germplasm banks to store seeds and vegetative material, ensuring genetic diversity.
- Application of forestry and permaculture techniques for the design of nurseries and reforestation areas, maximizing the resilience of the ecosystem.
- Continuous monitoring of reforested areas to evaluate the growth and adaptation of reintroduced species.

2. Community Education and Training

- Activities:

- Development and execution of educational workshops on biodiversity conservation, sustainable agricultural practices and adaptation to climate change.
- Creation of teaching materials and educational programs aimed at all ages, with special focus on schools in the Yucuna community.
- Training of community members as botanical garden guides, strengthening their role in ecotourism and environmental interpretation.



- Methodology:

- Implementation of participatory methodologies that involve the community in learning through "learning by doing."
- Use of non-formal environmental education techniques to facilitate understanding and interest in complex topics.
- Periodic evaluation of the impact of educational programs to continually adjust and improve content and delivery.

3. **Scientific Research and Monitoring

- **Activities:**

- Conducting phenological studies to document changes in plant life cycles due to climate change.
- Collaborations with universities and research centers for

biodiversity, ecology and conservation studies.

- Establishment of a network of meteorological stations and monitoring cameras to collect climatic and biological data in real time.



- Methodology:
 - Application of rigorous and standardized scientific methods for data collection and analysis.
 - Integration of information and communication technologies for the management of large volumes of data and its analysis.
 - Publication and dissemination of results to contribute to scientific knowledge and informed decision-making on conservation.

4. Sustainable Development and Economic Empowerment

- Activities:
 - Implementation of sustainable development projects that take advantage of natural resources in a responsible manner, such as beekeeping and agroforestry.
 - Promotion of local and regional markets for products derived from the garden, such as medicinal plants and crafts.

- Methodology:
 - Focus on the circular economy and clean production principles to minimize environmental impact.
 - Promotion of cooperation between the community and other actors to strengthen local value chains.

These activities are designed to create a lasting impact, not only on the conservation of the Amazon ecosystem but also on the socioeconomic well-being of the Yucuna community, making the Yucuna Botanical Garden a model of integrated and sustainable environmental management.

DESCRIPTION OF THE MAIN BENEFITS OF THE PROJECT

The Yucuna Botanical Garden project, located in the Colombian Amazon basin, aims to provide significant benefits at both an ecological, social and economic level, creating a positive impact on the Yucuna indigenous community and the local ecosystem. The main benefits expected from the development and implementation of this comprehensive project are detailed below.



Ecological Benefits

1. Conservation of Biodiversity:

- The project will contribute to the preservation of more than 500 species of flora, including several classified as Critically Endangered (CR) and Endangered (EN). By protecting these species within the Yucuna Botanical Garden, their long-term survival is ensured, providing a safe haven from deforestation and other adverse environmental impacts.

2. Restoration of Degraded Ecosystems:

- The reforestation and restoration of 50 hectares of degraded land will not only improve vegetation cover but also soil quality and water retention, which is crucial in an area prone to climate variability. This restoration process will also encourage the return of local fauna, reinforcing the food chain and natural ecological processes.

3. Climate Change Mitigation:

- Through the carbon capture carried out by the new planted vegetation, the project will help mitigate the effects of climate change. It is estimated that each reforested hectare can capture approximately 10 tons of CO₂ per year, which contributes significantly to the reduction of the region's

carbon footprint.

Social benefits

4. Education and Training:

- By offering workshops and educational programs, the project will strengthen the Yucuna community's knowledge of sustainable practices and environmental conservation. The training of 50 nature guides and the holding of 200 workshops per year will promote greater environmental awareness and practical skills that can be applied in the daily management of natural resources.



5. Cultural Strengthening:

- By integrating traditional practices and indigenous knowledge into the management of the Botanical Garden, the project will help preserve and revitalize the Yucuna culture. This includes the promotion of their traditional medicines, foods and crafts, reinforcing cultural identity and the transmission of ancestral knowledge to new generations.

Economic benefits

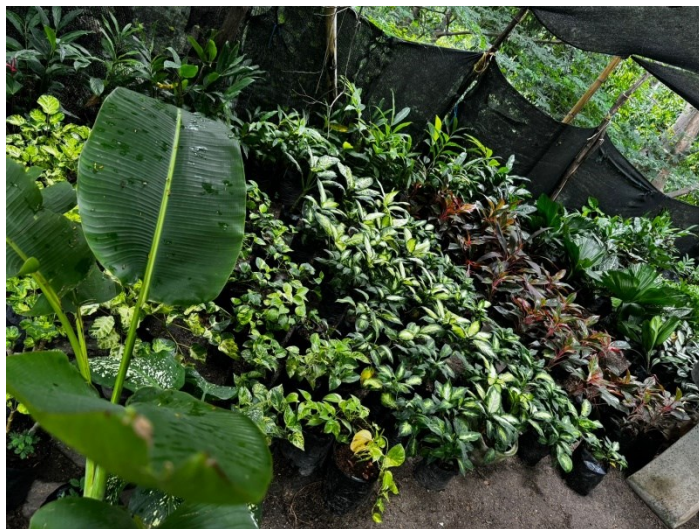
6. Income Generation:

- The development of ecotourism and the commercialization of products derived from the garden, such as medicinal plants, seeds and crafts, will provide new sources of income for the community. These activities are expected to not only diversify the local economy but also

improve the living standards of the families involved.

7. Job Creation:

- The project will generate direct and indirect jobs, from roles in garden management and maintenance to opportunities in tourist guidance and environmental education. The increase in tourist flow and the implementation of research projects are anticipated to attract more investments and create more job opportunities.



Long Term Benefits

8. Community Resilience:

- By improving local infrastructure and promoting self-sufficiency, the project will increase the resilience of the Yucuna community in the face of future challenges, especially those related to climate change. This will be achieved through improved natural resource management and the implementation of agricultural and conservation practices adapted to the changing climate.

9. Integrated Conservation Model:

- The Yucuna Botanical Garden will be positioned as a model for integrated conservation and sustainable development, demonstrating how communities can lead in preserving their own environment while improving their economic and social well-being.

These benefits underscore the transformative potential of the Yucuna Botanical Garden not only as a sanctuary for biodiversity but also as a catalyst for sustainable development and social justice in the Amazon basin.

FUNDING SOURCES

The Yucuna Botanical Garden, located in the rich and diverse Colombian Amazon Basin, faces the mission of conserving the region's unique biodiversity and strengthening the Yucuna indigenous community through educational and conservation programs. To ensure the viability and sustainability of this comprehensive project, it

is essential to have a robust and diversified financing scheme. Below are the main funding sources identified and how they will contribute to the development and maintenance of the garden.



1. International Grants and Donations

- International Conservation Organizations: The project has attracted the interest of several global organizations seeking to support the conservation of biodiversity in the Amazon. Funding commitments totaling \$150,000 have been secured from entities such as the World Wildlife Fund (WWF) and The Nature Conservancy, earmarked specifically for reforestation and environmental education initiatives.

- International Cooperation Agencies: Agencies such as USAID and the German GIZ have shown interest in financing parts of the project that align with their sustainable development objectives, including community training and institutional strengthening, with an estimated combined contribution of USD 100,000.

2. Government Funds

- National and Local Support: The Colombian government, through the Ministry of Environment and Sustainable Development, has allocated USD 75,000 to support the garden's infrastructure and endangered species conservation programs. Additionally, the local government provides annual grants of approximately \$30,000 for operations and maintenance.

3. Corporate Social Responsibility Initiatives

- Private Companies: National and international companies with a focus on sustainability and social responsibility have committed financial support. For example, a major cosmetics company interested in sustainable botanicals has pledged \$50,000 toward research and conservation of native medicinal plants.



4. Carbon Offset Programs

- Reforestation Initiatives: Given the garden's potential for carbon capture, a reforestation program has been developed that qualifies for carbon credits under international standards. This program hopes to generate around USD 40,000 annually by selling carbon credits to companies interested in offsetting their emissions.

5. Community Based Financing

- Microfinancing and Local Donations: A microfinancing campaign has been established to attract donations from individuals and smaller organizations, both nationally and internationally. This strategy aims to raise USD 20,000 a year, contributing to specific projects within the garden such as the construction of educational trails and recreation areas.

6. Income Generated by the Garden

- Ecotourism and Sale of Products: The garden plans to generate income through guided tours, educational workshops, and the sale of products derived from local flora, such as seeds, plants, and crafts. These activities are

projected to contribute approximately USD 30,000 per year, which will be reinvested in the maintenance and continued development of the garden.



7. Participation of Non-Governmental Organizations

- Local and Regional NGOs: Non-governmental organizations dedicated to the conservation of the Amazon and the support of indigenous communities also contribute, with annual contributions estimated at USD 25,000, destined mainly to education and training projects.

This diversified financing scheme not only ensures the necessary resources for the daily activities and long-term projects of the Yucuna Botanical Garden, but also promotes collaboration between different actors and the generation of its own income, fundamental for the sustainability of the project in the dynamic environment of the Amazon.

STUDIES THAT SUPPORT THE BASIC INFORMATION OF THE PROJECT

To ensure the effectiveness and sustainability of the Yucuna Botanical Garden, various investment components have been defined that cover infrastructural, educational, research and conservation needs. These components are essential for the functioning of the garden and to maximize its impact on biodiversity conservation and community development. The main investment components are described in detail below:

1. Infrastructure of the Botanical Garden

- Construction and Improvement of Facilities: Approximately USD 200,000 will be allocated for the development of critical infrastructure, including the construction of specialized greenhouses for the propagation of endangered species, as well as the improvement of irrigation systems and internal garden paths. These facilities will allow better management and conservation of the species, in addition to facilitating access for research and ecological tourism.

- Water Collection and Renewable Energy Systems: USD 50,000 will be invested in rainwater collection systems and

the installation of solar panels. These systems are essential to ensure the sustainability of the garden, reducing dependence on external energy sources and maximizing the efficient use of water.



2. Conservation and Restoration Programs

- Reforestation and Species Conservation: With an investment of USD 100,000, reforestation and habitat conservation projects will be financed. This includes planting native trees and restoring degraded areas, which is crucial to maintaining the ecological integrity of the region and providing habitats for local wildlife.

- Germplasm Banks and Nurseries: USD 75,000 will be allocated for the creation and maintenance of germplasm banks and nurseries, which are essential for the conservation of genetic material of threatened species and to facilitate programs for the reintroduction of species into their natural habitats.

3. Community Education and Training

- Development of Educational Programs: USD 80,000 will be invested in the development and execution of educational programs for the local community and visitors. These programs will focus on raising awareness about the importance of biodiversity and conservation, as well as training in sustainable agriculture techniques and natural resource management.

- Training and Certification of Local Guides: With a budget of USD 25,000, community members will be trained as tour guides and environmental educators, providing them with skills to generate income through ecotourism and actively contribute to the conservation of the garden.

4. Environmental Research and Monitoring

- Research Equipment: USD 60,000 will be allocated to equip the garden with tools and advanced technology for scientific research, including laboratory equipment and environmental monitoring devices. This will facilitate detailed studies on the impact of climate change on local species and ecosystems.

- Scientific Collaborations and Publications: USD 30,000

will be reserved to establish collaborations with universities and research centers, as well as for the publication of studies and findings in international scientific journals.



5. Sustainable Development and Income Generation

- Microenterprise Projects: With an investment of USD 40,000, small local businesses that use garden resources in a sustainable way will be supported, such as beekeeping, the production of medicinal plants and crafts. This not only promotes local economic development, but also teaches practices of sustainable use of natural resources.

These investment components are fundamental to the development and effective operation of the Yucuna Botanical Garden, ensuring that it fulfills its mission of environmental conservation and contribution to the well-being of the Yucuna community, all while promoting a sustainable model of environmental management.

STUDIES THAT SUPPORT THE BASIC INFORMATION OF THE PROJECT

To support and optimize the conservation and community development strategies of the Yucuna Botanical Garden, a series of scientific and technical studies have been used to provide the necessary basic information. These studies range from botanical research to socioeconomic analyses, and are crucial to ensuring that garden interventions are effective and sustainable. The main studies that support the project information and decisions are detailed below:

1. Biodiversity and Ecosystem Studies

- Flora and Fauna Inventory: Carried out in collaboration with the National University of Colombia, this study provided a complete census of the species present in the garden, including several endemic and endangered species. More than 500 plant species, 150 bird species, and 50 mammal species were recorded, underscoring the area's rich biodiversity and establishing a baseline for future conservation assessments.

- Phenological Studies: These studies, which examine the life cycles of plants in relation to climatic factors, have been

fundamental to understanding how climate change affects flowering and fruiting. The data indicate that 60% of species have altered their natural cycles due to variations in temperature and precipitation, which has direct implications for pollination and seed dispersal.



2. Analysis of the Impact of Climate Change

- Regional Climate Models: Using data from local weather stations and global models, these studies have projected temperature increases of up to 2°C and significant variations in rainfall patterns for the region over the next 50 years. These models are essential for planning garden adaptation and mitigation strategies.

- Ecological Vulnerability Studies: These studies evaluate the susceptibility of different species and ecosystems to the effects of climate change. For example, orchid species such as *Cattleya warneri* have been identified as especially vulnerable due to their dependence on specific climatic conditions for pollination.

3. Socioeconomic Research

- Community Surveys: Conducted among the local population, these surveys have helped identify the needs and concerns of the Yucuna community, including issues of education, employment, and access to resources. The results show that 80% of the community highly values the garden as a source of knowledge and as an economic resource.

-Economic Impact Studies: These analyzes have demonstrated how ecotourism initiatives and conservation

programs can significantly contribute to local economic development. It is estimated that the garden could generate up to USD 30,000 annually through activities related to tourism and the sale of products derived from biodiversity.



4. Environmental Impact Assessments

- Resource Sustainability Studies: Evaluating the carrying capacity of the ecosystem and levels of sustainable exploitation, these studies are vital to ensure that the garden's activities do not exceed the regenerative capacity of the natural environment. For example, it has been established that the garden can support up to 10,000 visitors a year without significant negative impacts.
- Ecosystem Services Analysis: These studies quantify the benefits provided by the garden ecosystem, such as carbon capture, water purification, and protection against erosion. The ecosystem services provided by the garden are estimated to be worth approximately USD 500,000 annually.

These studies not only provide the information essential for the effective management of the Yucuna Botanical Garden, but also ensure that interventions are supported by scientific data, thus maximizing the probability of success and long-term sustainability of the project.

TERRITORIAL PLANNING PLAN - STRATEGIES

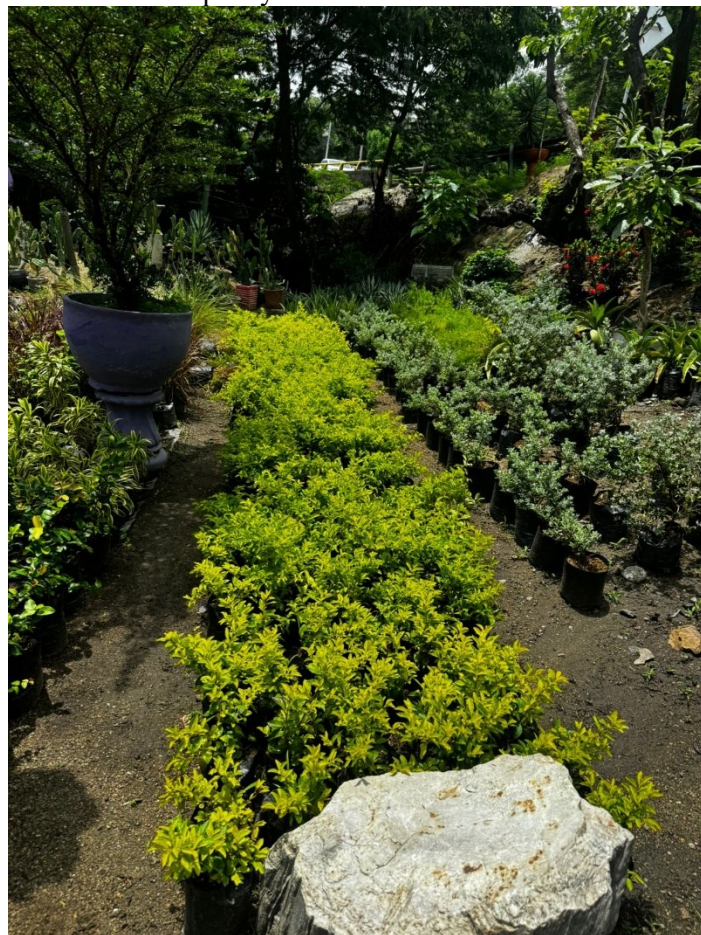
The Territorial Planning Plan (POT) for the Yucuna Botanical Garden is a critical component to ensure the effective conservation of its biodiversity and the sustainable use of its resources. This plan integrates detailed strategies that encompass ecological zoning, natural resource management, and the regulation of human activities within the area. Below are the main POT strategies for the garden:

1. Ecological Zoning

- Strict Conservation Zones: Areas will be designated within the garden where any type of human activity is prohibited, except controlled scientific research. These areas will host sensitive ecosystems and endangered species, such as *Cattleya warneri* and *Alstroemeria*

psittacina. The goal is to preserve these areas in their natural state to prevent degradation and allow ecological processes without human interference.

- Sustainable Use Zones: Activities such as environmental education, ecological tourism and certain forms of controlled harvesting will be permitted in these areas. These areas will be carefully managed to ensure that all activities are sustainable and contribute to resource conservation. Capacity limits will be established to minimize impacts, based on load capacity studies.



2. Natural Resources Management

- Water Management: Implementation of rainwater collection and storage systems to ensure water availability during the dry season and reduce extraction from local rivers. This is critical to maintain the necessary soil moisture and for watering plantings within the garden.
- Soil Conservation: Soil management practices that prevent erosion and improve fertility will be promoted, such as mulchization, the use of living barriers and crop rotation in areas of agroecological use.

3. Regulation of Activities

- Construction Regulations: Strict regulations will be established for any new construction within the garden, requiring that all structures be designed with green architecture principles, minimizing disruption to the landscape and using local and sustainable materials.
- Access and Mobility Control: Specific trails for visitors

will be designed and maintained, limiting access to sensitive areas. In addition, an eco-friendly internal transportation system, such as bicycles or electric vehicles, will be implemented to minimize pollution.

4. Education and Community Participation

- Educational Programs: Educational programs will be developed focused on the importance of sustainable resource management and conservation. These programs will be aimed not only at visitors, but also at the local community, including schools and community groups.

- Community Inclusion in Management: The active participation of the Yucuna community in the management of the garden will be promoted through management committees and training programs that allow them to make informed decisions about the use of resources.

5. Monitoring and Evaluation

- Continuous Monitoring Systems: Environmental monitoring systems will be implemented to regularly evaluate the health of the garden's ecosystems and the effectiveness of management measures. This will include monitoring biodiversity, water quality, soil health and the impact of tourist visits.

- Reviews and Adjustments of the POT: The territorial planning plan will be reviewed and adjusted every five years, based on the results of monitoring and scientific and technological advances, ensuring that the management of the Yucuna Botanical Garden remains at the forefront of practices conservation and sustainability.

These POT strategies not only seek to protect the natural resources of the Yucuna Botanical Garden, but also to ensure that their use and enjoyment are carried out in a way that benefits current and future generations, aligning conservation objectives with community development and environmental education.

PROJECT MANAGEMENT

Effective management of the Yucuna Botanical Garden project is crucial to achieving its conservation, education, and community integration objectives. The management structure has been designed to ensure that all activities are carried out in a coordinated manner and that benefits to biodiversity and the local community are maximized. The project management is described in detail below:

Organizational structure

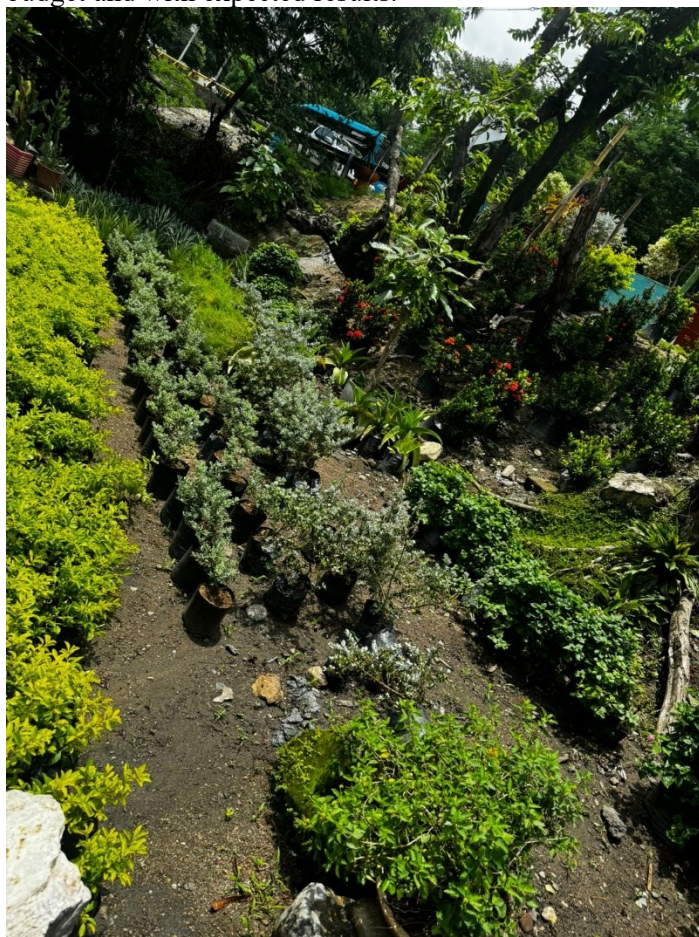
1. Executive Management: The project is managed by an Executive Director, who has extensive experience in managing conservation and community development projects. This leader is responsible for the overall supervision of the project, ensuring that all activities align with the garden's vision and strategic objectives.

2. Advisory Council: An advisory council composed of experts in botany, ecology, natural resource management and representatives of the Yucuna community provides strategic guidance and oversight. This council meets quarterly to evaluate project progress and adjust policies as necessary.

3. Area Coordinators: There are several coordinators specialized in key areas such as conservation, education, research, and community development. These coordinators manage the teams within each area, oversee daily activities and report directly to the Executive Director.

Operational Management

4. Project Planning and Execution: Management includes detailed planning of each component of the project, from reforestation to educational programs. Project management methodologies such as PMBOK or PRINCE2 are used to ensure that all activities are completed on time, within budget and with expected results.



5. Financial Management: A specialized finance team, led by a certified public accountant, handles all financial aspects of the project, including budgeting, cash flow management, and financial reporting. This team also oversees the acquisition of funds, ensuring transparent and efficient administration of resources.

6. **Monitoring and Evaluation:** A monitoring and evaluation system is implemented to track progress toward project objectives and measure the impact of activities. This system includes performance indicators that are reviewed semi-annually, allowing for quick adjustments to project strategy and tactics as necessary.

Community participation

7. **Community Integration:** A fundamental component of project management is the active inclusion of the Yucuna community in all phases of the project. Mechanisms are established for community participation in the planning, execution, and evaluation of activities, ensuring that the project not only benefits but is also owned by the community.

8. **Training and Skills Development:** Regular training programs are implemented for garden staff and the local community, with the aim of improving their skills in areas such as tourist guiding, natural resource management, and conservation techniques. This not only contributes to the sustainability of the project, but also increases the employability of individuals.

Communication and public relations

9. **Communication Strategy:** A comprehensive communication strategy ensures that all stakeholders, including donors, the local community and the general public, are well informed about the progress and achievements of the project. This includes regularly updating the garden's website, newsletters, and presentations at conferences and seminars.

10. **Media Relations and Promotion:** Active contact is maintained with the media to promote the work of the garden, attract visitors and increase awareness about the importance of biodiversity conservation in the Amazon.

This comprehensive management approach ensures that the Yucuna Botanical Garden not only meets its environmental and educational objectives, but also fosters sustainable and inclusive development, benefiting the Yucuna community and preserving its rich natural heritage for future generations.