



**ORNITHOLOGICAL TOURISM
ETHNOPROGRAM IN THE
COLOMBIAN ANDEAN
MOUNTAINS**

By: ENVIRONMENTAL WOMEN ORG

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SUMMARY

This program, spearheaded by Environmental Women ORG, focuses on ornithological observation using augmented reality to promote the conservation of bird species in 9,800 hectares of the Sierra Nevada de Santa Marta, a biodiversity hotspot in Colombia's Andean mountains. It aims to integrate technology with sustainable ecotourism, creating an innovative model that balances environmental conservation, cultural preservation, and economic empowerment for the indigenous Narakajmanta community.

The project prioritizes the protection and observation of key avian species, including hummingbirds, vultures, hawks, and owls. Specific species such as the King Vulture (*Sarcorampus papa*), Dwarf Kite (*Gampsonyx swainsonii*), Gray-lined Hawk (*Buteo nitidus*), Collared Forest Falcon (*Micrastur semitorquatus*), Ferruginous Pygmy Owl (*Glaucidium brasilianum*), and Black-and-white Owl (*Ciccaba nigrolineata*) are focal points of conservation efforts due to their ecological importance and cultural significance to the Narakajmanta. The augmented reality application will allow users to visualize these species in their natural habitats, fostering education and awareness among tourists while minimizing human interference.

The program targets 5,000 beneficiaries, comprising 300 indigenous Narakajmanta families distributed as follows: 2,600 women, 2,300 men, and 100 non-binary individuals, spanning three age groups: <18 years (1,350), 18-35 years (2,750), and >35 years (900). Economic activities of the community include 1,250 peasants, 250 fishermen, 510 artisanal miners, 1,810 farmers, and 1,180 housewives, collectors, and artisans, all of whom will benefit directly from sustainable income generation through tourism.

The methodology includes the development of educational and entertainment content tailored to each species, accessible via an interactive mobile application. The app will feature real-time augmented reality overlays of the avian species, including their sounds, behaviors, and ecological roles, enabling tourists to engage with the environment while learning about conservation. The program will also establish guided observation trails, strategically located to ensure minimal disruption to habitats while optimizing birdwatching experiences. Infrastructure upgrades, such as bird blinds and observation towers, will enhance accessibility and provide safe viewing opportunities.

The program also incorporates a community-based monitoring system, where trained indigenous guides will use geospatial tools and traditional ecological knowledge to protect critical habitats. Conservation actions include habitat restoration across 2,000 hectares, targeting areas impacted by deforestation and illegal activities. In addition, environmental education campaigns will engage tourists and local stakeholders, emphasizing the importance of avian species as indicators of ecosystem health.

The economic impact of the program is projected to generate a 30% increase in household incomes within three years through sustainable ecotourism. Tour packages, priced competitively, will include augmented reality experiences, guided trails, and educational workshops, with the revenue reinvested in community development and conservation initiatives. The program will also reduce illegal logging and hunting activities by creating alternative livelihoods for at least 150 community members, ensuring sustainable resource management.

¹ENVIRONMENTAL WOMEN ORG, founded in 2009, is an ecofeminist organization operating in the Colombian Andean mountains. Made up of six indigenous women leaders and a network of 50 volunteers from the University of Magdalena and the NARAJAHMANTA community, the organization focuses on promoting the fight against climate change, the conservation of biodiversity and environmental justice through gender equality. Our main focus is to implement programs that integrate technology with water management and sustainable practices, aimed at improving the living conditions of indigenous communities while preserving their ancestral territories. To date, we have developed more than 10 significant projects, directly impacting more than 5,000 people in vulnerable areas, with a managed budget that exceeds \$500,000 USD in the last two years. Our work is recognized for its contribution to the empowerment of indigenous women in leadership and environmental management roles.

By integrating advanced technology with local expertise, this program establishes the Narakajmanta community as a global leader in climate-integrated ecotourism. It aligns with Sustainable Development Goals (SDGs) 13 (Climate Action), 15 (Life on Land), and 5 (Gender Equality), contributing to the protection of biodiversity while empowering indigenous women leaders. This initiative serves as a replicable model for other biodiversity-rich regions facing similar challenges.

INTRODUCTION

The program "Ornithological Ecotourism Based on Augmented Reality", led by Environmental Women ORG, represents an innovative initiative for bird conservation and sustainable development in the Sierra Nevada de Santa Marta, a critical ecosystem of the Colombian Andes. This territory, which covers 9,800 hectares within the Narakajmanta indigenous territory, is a biodiversity hotspot recognized for its richness in birdlife, hosting more than 30 key species for ecological balance, including hummingbirds, vultures, hawks and owls.



The main objective of the program is the conservation of emblematic and endangered avian species, such as the King Vulture (*Sarcorampus papa*), the Lesser Kite (*Gampsonyx swainsonii*), the Saravian Sparrowhawk (*Buteo nitidus*), the Collared Mountain Falcon (*Micrastur semitorquatus*), the Ferruginous Owl (*Glaucidium brasilianum*) and the Black-capped Owl (*Ciccaba nigrolineata*). These birds not only have ecological value as predators and pest controllers, but also have a deep cultural meaning for the Narakajmanta community, who consider them symbols of balance and strength.

The Sierra Nevada de Santa Marta faces critical threats from deforestation, agricultural expansion and the effects of climate change, which have reduced the areas of suitable habitat for birds by 25% in the last two decades. This program seeks to reverse this trend by implementing a sustainable ecotourism model based on augmented reality technology, which allows for interactive observation of these species in their natural habitat, combining environmental education, active conservation, and economic empowerment of the indigenous community.

The beneficiary population is made up of 5,000 Narakajmanta indigenous people organized into 300 families, distributed by gender into 2,600 women, 2,300 men, and 100 non-binary people. By age, 27% are under 18 years old (1,350 people), 55% are between 18 and 35 years old (2,750 people), and 18% are over 35 years old (900 people). The community includes 1,250 peasants, 250 fishermen, 510 artisanal miners, 1,810 farmers, and 1,180 housewives, collectors, and artisans, who will be directly involved in the implementation of the program, acquiring new skills in tourism, conservation, and use of technologies.

The technological component includes a mobile application with augmented reality functions that will allow visitors to view three-dimensional models of the target birds, listen to their songs, and learn about their habits and ecological role. In addition, observation trails equipped with towers, sighting points, and guides trained in herpetology will be established, ensuring an educational and low-environmental-impact experience. It is also planned to restore 2,000 hectares of critical habitats and reduce illegal activities such as hunting and logging by 40%.



The program not only seeks to protect biodiversity, but also to generate a positive economic impact, increasing the income of Narakajmanta households by 30% through

ecotourism. This will be achieved through tourist packages that integrate guided tours, interactive activities and educational workshops, with income reinvested in community projects. In short, this program will position the Narakajmanta community as a global benchmark in climate-integrated ecotourism, aligning its actions with Sustainable Development Goals 13 (Climate Action), 15 (Life on Land) and 5 (Gender Equality).

MATERIALS AND METHODS

The program will employ a combination of technological resources, physical infrastructure, and human capital, designed to implement an innovative model of sustainable ecotourism. Key materials include:

1. Observation infrastructure:

- o Construction of 5 observation towers and 8 observation shelters strategically located in areas of high avian activity, spanning the 9,800 hectares of the program.
- o Installation of interpretive signage and physical guides at key points, providing information on species such as the King Vulture (*Sarcoramphus papa*) and the Black-capped Owl (*Ciccaba nigrolineata*).

2. Augmented reality technology:

- o Development of an interactive mobile application, compatible with Android and iOS, equipped with:
 - Three-dimensional models of birds such as the Collared Mountain Falcon (*Micrastur semitorquatus*) and the Lesser Kite (*Gampsonyx swainsonii*).
 - GPS location recognition to integrate real-time visualizations.
 - Educational games and questionnaires to increase user participation.

3. Community equipment:

- o Provision of 30 environmental monitoring kits, including camera traps, binoculars, sound recorders and portable GPS, for use by trained indigenous guides.
- o Technical training for 50 local guides, who will combine traditional and scientific knowledge in their tourism services.

4. Educational material:

- o Production of printed and digital manuals in indigenous languages and Spanish, detailing the biology, behavior and conservation of key birds.
- o Audiovisual material such as videos and mini-documentaries that capture the interaction between birds and their environment.

Methods

The program will be implemented through a sequential methodological approach, integrating technology with traditional and sustainable ecotourism practices.

1. Species selection and route location

- A field survey will be carried out to identify priority species, considering the presence of emblematic birds such as the Saraviado Hawk (*Buteo nitidus*) and hummingbirds.
- Sighting routes will be defined based on maps of geographic distribution and critical habitats, covering 5 main ecosystems within the Sierra Nevada.

2. Development of the mobile application

- The design will include high-resolution images, sounds recorded in the field and interactive 3D models of the target species.
- An alert system will be integrated to notify tourists about adverse weather events or relevant sightings.

3. Community training

- 50 Narakajmanta guides will receive specialized training in ecotourism, management of technological tools and bird conservation.
- Participatory workshops will be held with 300 beneficiary families, strengthening local knowledge about the ecological and economic importance of birds.



4. Monitoring and conservation

- A community monitoring system will be established, using camera traps to record the activity of species such as the Ferruginous Owl (*Glauclidium brasilianum*).
- Observation areas will be protected through agreements with the indigenous tribal council to minimize human impacts.

5. Impact assessment

- Key indicators such as increased tourism revenue (target: 30% in three years) and recovery of degraded habitats

(target: 2,000 hectares restored) will be monitored.

- Tourist satisfaction surveys and biodiversity data analysis will measure the success of the program.

Together, these materials and methods ensure efficient implementation of the program, promoting the conservation of key birds and generating tangible benefits for the Narakajmanta community.

PROGRAM BENEFICIARIES

The program directly benefits 5,000 indigenous Narakajmanta people, distributed across 300 families who inhabit the 9,800 hectares assigned to the project within the Sierra Nevada de Santa Marta, an ancestral territory of 14,400 hectares. This pre-Columbian community faces critical challenges related to biodiversity conservation and access to sustainable income, which the program addresses by promoting ecotourism based on augmented reality technology.



Demographic Composition

Beneficiaries include:

- 2,600 women (52%), who play key roles in environmental conservation, community leadership, and ecotourism entrepreneurship.
- 2,300 men (46%), in charge of agricultural activities, fishing, and artisanal mining, who also participate in the implementation of sustainable practices.
- 100 non-binary people (2%), who represent a growing sector within the social and economic structure of the community.

By age range, the beneficiaries are divided into:

- <18 years: 1,350 people (27%), who will be sensitized through educational workshops on the importance of birds and the environment.
- 18-35 years: 2,750 people (55%), the most active working population, who will lead guiding, conservation and management activities of ecotourism ventures.
- >35 years: 900 people (18%), who will contribute with their experience in traditional techniques and cultural

knowledge about avian species.

Occupations and Economic Activities

The Narakajmanta community is mainly dedicated to:

- 1,250 farmers (25%), responsible for agricultural production, who will diversify their income by offering local products to tourists.
- 250 fishermen (5%), who will participate in river routes complementary to observation ecotourism.
- 510 artisanal miners (10%), who will receive support to move towards more sustainable activities.
- 1,810 farmers (36%), who will take advantage of reforestation and habitat recovery to strengthen the biodiversity of the area.
- 1,180 housewives, gatherers and artisans (24%), many of whom will lead innovative ecotourism ventures.



Female Empowerment and Ecotourism Ventures

One of the central focuses of the program is to strengthen the leadership of the 2,600 Narakajmanta women, promoting their role as managers of ecotourism initiatives. The creation of 25 ventures led by women is planned, focusing on:

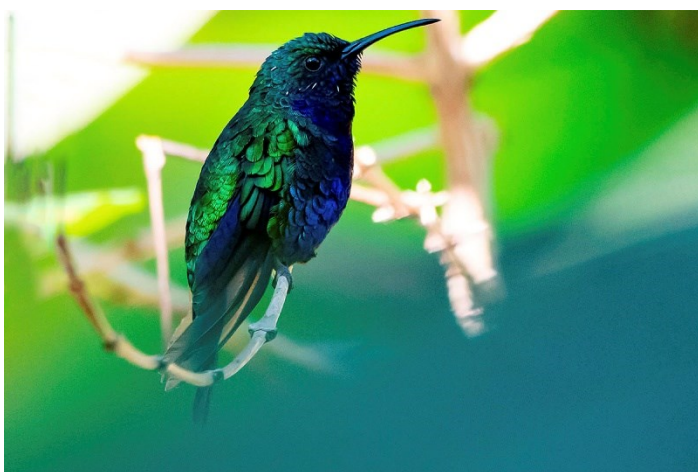
1. Specialized guidance: Women trained in ornithology, who will lead observation routes highlighting species such as the King Vulture and the Black-faced Owl.
2. Environmentally-themed crafts: Production of pieces inspired by emblematic birds, generating an additional sustainable income.
3. Local gastronomy: Development of culinary experiences that integrate traditional ingredients, attracting tourists interested in the Narakajmanta culture.
4. Environmental education: Women as facilitators of

educational workshops for tourists and local youth, strengthening knowledge about bird conservation.

Impact on the Community

The program will generate significant social and economic benefits:

- It will increase family income by 30% in three years through economic diversification based on ecotourism.
- It will train 50 community guides, of which at least 30 will be women leaders.
- It will protect biodiversity by reducing illegal activities such as poaching and logging by 40%.
- It will raise awareness among 1,350 children and adolescents, ensuring the intergenerational transfer of knowledge about conservation.



In conclusion, the beneficiaries of the program will not only be recipients of its impacts, but also key actors in its implementation, consolidating their role as protectors of the natural environment and managers of a sustainable ecotourism model that integrates technology, conservation and gender equity.

TOURISM STRATEGY

The tourism strategy of the program "Birdwatching Ecotourism Based on Augmented Reality" combines biodiversity conservation with the development of an innovative model of sustainable ecotourism, designed to generate positive economic, social and environmental impacts in the Narakajmanta indigenous community. This approach integrates cutting-edge technology, sustainable practices and a strong cultural component, positioning the Sierra Nevada de Santa Marta as an ecotourism destination of high global relevance.

1. Segmentation of the Tourism Market

The program is aimed at:

- National and international ecotourists interested in birdwatching and sustainable experiences, with a focus on key markets such as Europe, North America and the rest of Latin America.
- Researchers and academics specialized in ornithology and environmental conservation, who will find in the program a platform to study endemic and emblematic species.
- Educational and family tourism, providing interactive and educational tools that encourage the participation of young people and families in environmental activities.



2. Creation of Tourist Products and Services

2.1. Sighting Routes

Five main observation routes will be established within the 9,800 hectares of the assigned territory, each designed to highlight the biodiversity and specific habitats of species such as the King Vulture (*Sarcoramphus papa*), the Saraviated Hawk (*Buteo nitidus*) and the Black-faced Owl (*Ciccaba nigrolineata*). These routes will include:

- Sighting towers and ecological refuges in strategic locations that minimize human impact on ecosystems.
- Informative signage in Spanish and English, highlighting ecological data, behaviors and threats of each species.

2.2. Technological Experiences

The use of the augmented reality application is a central pillar of the strategy. Tourists will be able to:

- View birds in real time through interactive 3D models, listening to their songs and learning about their behavior.
- Access to georeferenced maps that guide your experience, with information on key points and biodiversity data.

2.3. Tourist Packages

Diversified packages will be designed for different visitor profiles, which will include:

- Tours guided by Narakajmanta indigenous guides, who

will combine scientific and traditional knowledge.

- Complementary activities such as environmental education workshops, visits to craft projects and local gastronomic experiences.
- Competitive costs ranging from \$50 to \$200 USD per visitor, generating sustainable income for the community.

3. Local Training and Empowerment

The program will train 50 local guides, of which at least 60% will be women, strengthening their knowledge in ornithology, technology management and customer service. In addition, the development of women-led ventures in areas such as gastronomy and crafts will be encouraged.



4. Promotion and Marketing

The marketing strategy includes:

- Digital campaigns on social media and tourism platforms, highlighting interactive images and videos of emblematic species such as the Collared Mountain Falcon (*Micrastur semitorquatus*).
- Collaborations with sustainable tourism agencies and environmental organizations to integrate the program into international tourism packages.
- Participation in tourism fairs and specialized events to position the destination in key markets.

5. Conservation and Sustainability

Ecotourism will be based on responsible practices to minimize environmental impact, such as:

- Limited carrying capacity, restricting the number of visitors per route to 30 people per day.
- Reinvestment of 50% of income in conservation activities, such as the restoration of 2,000 hectares of critical habitat.

- Promotion of community agreements to protect sighting areas and ensure their sustainable use.

6. Monitoring and Evaluation

The tourism impact will be evaluated through key indicators such as:

- 30% increase in family income from tourism in three years.
- Visitor satisfaction (goal: 90% positive ratings).
- Recovery of degraded habitats (goal: 2,000 hectares restored).

In summary, this tourism strategy combines technology, conservation and community participation to position the Sierra Nevada de Santa Marta as a global model of sustainable ornithological ecotourism, guaranteeing tangible benefits for biodiversity and the Narakajmanta community.



TECHNOLOGICAL STRATEGY

The technological strategy of the program "Augmented Reality-Based Birdwatching Ecotourism" aims to integrate advanced digital tools with sustainable practices to

maximize the experience of tourists, ensure biodiversity conservation, and empower the Narakajmanta indigenous community. This approach leverages innovative technologies such as augmented reality (AR), georeferencing, and digital environmental monitoring, ensuring a positive and sustainable impact on the 9,800 hectares of the Sierra Nevada de Santa Marta.

1. Development of an Augmented Reality Application

The core of the technological strategy is a mobile application designed for Android and iOS devices, which will allow tourists to interact with biodiversity in an educational and entertaining way. This tool will include:

- 3D models of key birds such as the King Vulture (*Sarcoramphus papa*) and the Ferruginous Owl (*Glaucidium brasilianum*), which can be viewed in real time in their natural environment.
- Georeferenced maps with points of interest, sighting routes and critical biodiversity locations, optimizing user navigation.
- GPS recognition, which will activate specific content based on the user's location, such as detailed information on avian species observed in each area.
- Interactive games and quizzes to promote active learning about species behavior, biology and conservation.

Expected impact:

- Reach 2,000 users in the first year, with projected growth of 20% annually.
- Improve tourists' understanding of local birds, assessed through post-visit surveys with a goal of 85% satisfaction.

2. Digital Environmental Monitoring System

The strategy incorporates environmental monitoring tools based on digital technologies for the conservation of habitats and avian species. This includes:

- Camera traps: Installation of 20 devices in key areas to monitor the activity of species such as the Collared Mountain Falcon (*Micrastur semitorquatus*).
- Climate and air quality sensors: Implementation of 10 monitoring stations to assess environmental conditions and their impact on birds.
- Cloud data platform: Integration of a data management system to store, analyze and share information on biodiversity with researchers and communities.

Expected impact:

- Generate an ecological data repository that contributes to 10 scientific publications in three years.
- Detect changes in habitats within a maximum period of 90

days to implement corrective measures.

3. Training in Digital Technologies

The program will train 50 Narakajmanta guides in the use of technologies such as:

- Augmented reality: Training to facilitate the use of the mobile application during tourist tours.
- Environmental monitoring: Training in the use of camera traps, sensors and data analysis platforms.
- Creation of digital content: Production of audiovisual material to strengthen the promotion of ecotourism on social networks and digital platforms.

Expected impact:

- Increase the technological capacity of local guides by 60%, evaluated through practical post-training tests.
- Promote 25 digital ventures led by women, linked to the creation of environmental and educational content.



4. Digital Promotion Strategy

A digital campaign focused on global reach and environmental awareness will be implemented:

- Social networks: Generation of interactive content (360° videos, infographics, live broadcasts) to attract ecotourists with a high interest in conservation.
- Ecotourism platforms: Collaboration with specialized portals to promote tourist packages based on technological experiences.
- Gamification: Integration of digital rewards (certificates, virtual medals) for frequent users of the application.

Expected impact:

- Reach 5,000 unique users on digital platforms in the first year.
- Increase the international visibility of the program, with a goal of 20% of tourist reservations generated by digital means.

5. Technological Monitoring and Evaluation

The results of the technological strategy will be measured through:

- Application adoption rate: Goal of 70% of visitors using the tool during their experience.
- Reduction of illegal activities: Use of cameras and sensors to reduce hunting and logging by 40% in three years.
- User satisfaction: Periodic evaluations of the technological experience with a goal of 90% positive ratings.

In summary, this technological strategy combines innovation, training and conservation to position the Sierra Nevada as a model of smart ecotourism, beneficial to the environment and the environment.

EDUCATIONAL STRATEGY

The educational strategy of the program seeks to promote environmental awareness, technical learning, and cultural appropriation of knowledge related to biodiversity, especially the emblematic avian species of the Sierra Nevada de Santa Marta. This strategy combines traditional methodologies and innovative technologies to impact 5,000 Narakajmanta beneficiaries, including tourists, local guides, and indigenous families.

1. Comprehensive Educational Content

1.1. Focus on Emblematic Species

The program will develop educational content focused on key birds such as the King Vulture (*Sarcoramphus papa*), the Black-capped Owl (*Ciccaba nigrolineata*), and the Collared Mountain Falcon (*Micrastur semitorquatus*). Each species will be studied and presented in accessible formats, including:

- Fact sheets detailing their biology, behavior, and ecological role.
- Interactive videos recorded in their natural habitat, with subtitles in indigenous languages and Spanish.
- Dynamic infographics designed to highlight the threats they face and the necessary conservation measures.

1.2. Digital and In-Person Material

The educational content will be integrated into digital and physical tools, such as:

- An augmented reality application, which will allow users to virtually interact with the birds and explore their characteristics in real time.
- Trilingual educational manual (Spanish, Narakajmanta language and English), distributed to 300 families and available in digital format.
- Information points on the 5 sighting trails, equipped with interactive signage combining text and QR codes.



2. Workshops and Training

2.1. Training for Local Guides

50 Narakajmanta guides will be trained, of which at least 60% will be women, in key areas such as:

- Environmental interpretation techniques and management of tourist groups.
- Use of technologies such as augmented reality applications and monitoring equipment.
- Integration of traditional knowledge about birds and their cultural relationship with the community.

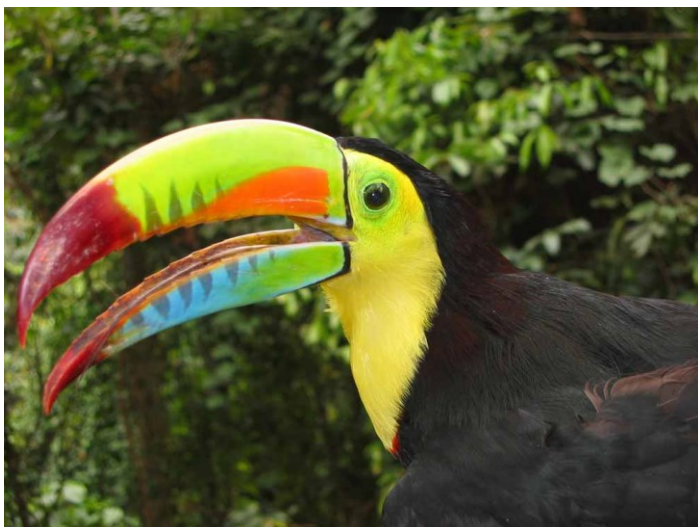
2.2. Community Workshops

The workshops aimed at the 300 beneficiary families will include:

- Biodiversity conservation: Explanation of the importance of birds as ecological indicators and their connection with ecosystems.
- Ecotourism and sustainable entrepreneurship: Guidance on how to turn tourism into a source of income, with an emphasis on roles led by women.
- Intergenerational education: Practical activities for children and adolescents, promoting the transfer of knowledge to younger generations.

Expected impact:

- A 40% increase in knowledge about biodiversity within participating families in the first two years.
- Training 100 young people under 18 years of age as agents of environmental change in their community.



3. Focus on Active Participation

The educational strategy includes interactive methods to encourage learning:

- Interactive games on the mobile app, allowing tourists to identify species such as the Lesser Kite (*Gampsonyx swainsonii*) and learn about its habitat.
- Mini-documentaries produced in collaboration with the community, highlighting its role in conservation and the stories behind its relationship with birds.
- School competitions on biodiversity and sustainability, involving 5 local schools.

4. Promotion of Environmental Awareness

Educational campaigns will be implemented at regional and national levels, including:

- Publication of 4 annual educational blogs on digital platforms about the birds of the Sierra Nevada.
- Partnerships with educational and environmental institutions, for the dissemination of materials and the organization of events such as bird watching days.

Expected impact:

- Raise awareness among 3,000 tourists annually about the importance of bird conservation.
- To get 50% of Narakajmanta families to adopt sustainable practices related to the protection of local ecosystems.

5. Monitoring and Evaluation

The educational impact will be evaluated through:

- Post-workshop surveys to measure the increase in knowledge, with a goal of 90% satisfaction among participants.
- Community impact indicators, such as active participation in conservation activities and the reduction of unsustainable

practices.

In summary, the educational strategy integrates technology, traditional knowledge and participatory methodologies to promote the conservation of birds in the Sierra Nevada, empower the Narakajmanta community and generate a replicable model of sustainable environmental education.

SUSTAINABILITY STRATEGY

The sustainability of the program "Ornithological Ecotourism Based on Augmented Reality" is based on the creation of an indigenous ecotourism production chain that integrates the Narakajmanta community in all phases of the process. This strategy seeks to generate long-term economic, social and environmental impacts, guaranteeing the preservation of biodiversity and the empowerment of the 300 beneficiary families, made up of 5,000 people, of which 52% are women.

1. Structure of the Production Chain

The indigenous ecotourism production chain is organized into three main levels:

1.1. Production of Ecotourism Services

- Guided tours: Training of 50 local guides, prioritizing the participation of women (at least 60%), who will offer specialized tours on the 5 sighting routes. Guides will combine traditional and scientific knowledge, highlighting key species such as the King Vulture (*Sarcoramphus papa*) and the Collared Mountain Falcon (*Micrastur semitorquatus*).
- Tourism infrastructure: Operation of 5 birdwatching towers and 8 eco-refuges, designed with sustainable materials to minimize environmental impact and maximize the tourist experience.

1.2. Production of Associated Goods

- Thematic crafts: Production of crafts inspired by local birds, led by 50 women artisans. These will include ceramic figures, embroidered textiles and jewelry with bird designs such as the Ferruginous Owl (*Glaucidium brasilianum*).
- Local gastronomy: Development of a culinary offering based on native ingredients, prepared by 30 female entrepreneurs, highlighting traditional dishes with cultural narratives associated with biodiversity.

1.3. Marketing and Promotion

- Digital platform: Creation of a website and a mobile application for the promotion of tourist services, the sale of handicrafts and the reservation of tourist packages. It is expected to reach 5,000 users in the first year.

- Strategic alliances: Collaboration with sustainable tourism agencies and environmental NGOs, guaranteeing the visibility of the program in international markets.

2. Financial Model

The financial model prioritizes the reinvestment of income in conservation and community development activities:

- Projected income: It is estimated to generate \$100,000 USD annually in the first three years, with a 15% annual growth thanks to the increase in the tourist flow.
- Community reinvestment: 50% of the income will be allocated to:
 - o Restoration of 2,000 hectares of critical habitats.
 - o Maintenance of the tourist infrastructure.
 - o Microcredit funds to strengthen women-led ventures.

3. Capacity Building

A continuous training plan will be implemented that includes:

- Technical workshops on management of tourism services, quality of customer service and digital marketing strategies.
- Environmental training to promote sustainable practices among producers of goods and services.
- Intergenerational transfer of knowledge, with the inclusion of 1,350 young people under 18 years of age in educational programs.

4. Monitoring and Evaluation

The sustainability of the production chain will be monitored through key indicators:

- Economic impact: 30% increase in family income in three years.
- Social impact: Incorporation of 80% of beneficiary families in at least one phase of the production chain.
- Environmental impact: 40% reduction in illegal activities such as poaching and logging.

5. Linked Conservation Practices

The production chain will be directly linked to conservation:

- Community commitment: Each family participating in the chain must sign agreements on non-hunting and protection of key habitats.
- Environmental monitoring: Use of 20 camera traps and sensors to record target species and assess ecosystem health.

6. Promotion of Innovation

The production chain will foster innovation in:

- Cultural products: Development of new crafts and tourism

experiences based on augmented reality.

- Digital marketing: Use of e-commerce platforms to expand the global reach of indigenous goods and services.

In short, this sustainability strategy guarantees the long-term success of the program by combining responsible use of resources with economic development and empowerment of the Narakajmanta community, positioning it as a model of indigenous ecotourism in Latin America.



EXPECTED RESULTS

The program aims to generate measurable results in three key areas: environmental conservation, socioeconomic impact, and cultural strengthening, in line with the sustainable development objectives and specific goals for the Narakajmanta indigenous community. The expected results are detailed below, supported by quantifiable indicators that will allow evaluating its success in the short, medium, and long term.

1. Environmental Results

1.1. Biodiversity Conservation

- Restoration of 2,000 hectares of critical habitats in the Sierra Nevada de Santa Marta, improving the conditions of ecosystems that host key avian species such as the King Vulture (*Sarcoramphus papa*) and the Collared Mountain Falcon (*Micrastur semitorquatus*).
- 15% increase in the population of monitored avian species over a three-year period, assessed through records obtained by 20 camera traps and environmental sensors.
- 40% reduction in illegal activities, including poaching and logging, through the implementation of community conservation agreements and constant monitoring.

1.2. Environmental Education

- Awareness raising of 3,000 tourists annually, who will receive information on the ecological importance of birds and the threats they face, through guided activities and interactive content in the augmented reality application.
- Active participation of 1,350 Narakajmanta children and adolescents, who will be trained in conservation practices and sustainable ecotourism.



2. Socioeconomic Results

2.1. Income Generation

- 30% increase in family income for the 300 beneficiary families within three years, thanks to the integration of ecotourism activities and the sale of associated products.
- Creation of 50 direct jobs, of which at least 60% will be occupied by women, who will lead guiding, crafts and local gastronomy initiatives.
- Development of 25 women-led ventures focused on the production of themed crafts and the offering of specialized tourism services.

2.2. Economic Diversification

- Establishment of an indigenous ecotourism production chain that integrates tourism services, production of cultural goods, and digital promotion, with estimated revenues of \$100,000 USD annually in the first three years.
- Marketing of 10,000 units of themed crafts and gastronomic products annually, increasing sustainable income opportunities.

3. Cultural Results

3.1. Rescue and Promotion of Traditional Knowledge

- Incorporation of traditional knowledge in the narration of cultural stories during guided tours, strengthening the link between indigenous practices and the conservation of species such as the Black-faced Owl (*Ciccaba nigrolineata*).
- Production of 4 annual educational blogs and a mini-documentary documenting conservation practices and their impact on biodiversity, contributing to the global visibility of the Narakajmanta community.

3.2. Strengthening Community Identity

- Empowerment of 2,600 Narakajmanta women, who will assume leadership roles in the implementation of the program, promoting gender equality within the community.
- Promotion of indigenous language and traditions through bilingual educational materials, distributed in community workshops and on sighting routes.

4. Technological Results

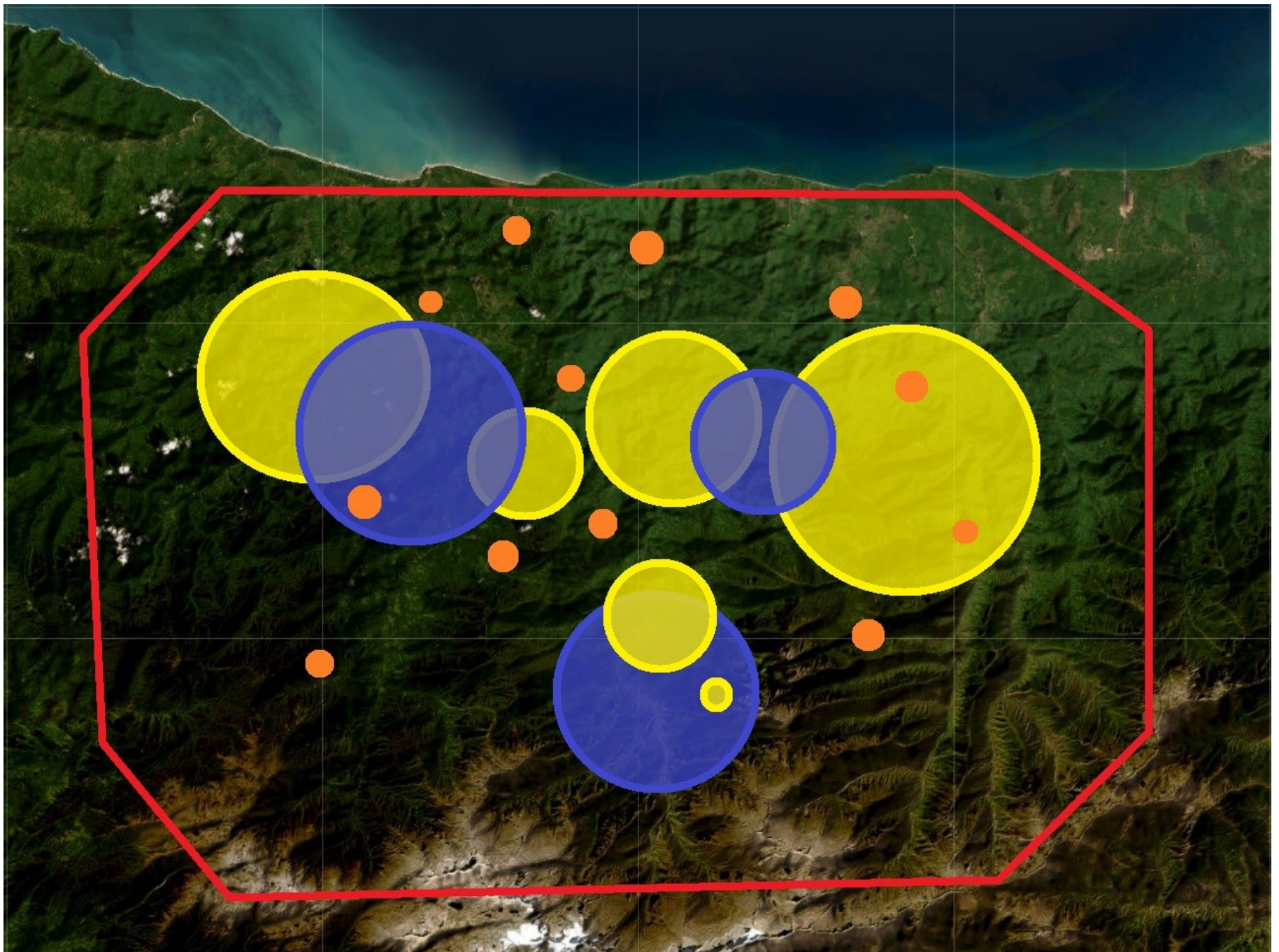
- 70% of tourists will use the augmented reality application during their visit, increasing their interaction with the species and their learning about conservation.
- Storage of 50,000 ecological data on a digital platform, used for scientific research and the continuous improvement of conservation strategies.
- Evaluation of tourist satisfaction, with a goal of 90% positive ratings, ensuring that the tourist experience is educational, innovative and sustainable.

5. Evaluation and Sustainability

- Publication of three annual reports on the impact of the program, highlighting achievements in conservation, income generation and community education.
- Consolidation of the program as a replicable model of sustainable ecotourism, with two international alliances established to promote similar practices in other regions of high biodiversity.

In conclusion, the program seeks to transform the Narakajmanta community into a global benchmark for sustainable ecotourism, combining conservation, technology and community empowerment to generate tangible impacts on biodiversity and the quality of life of its inhabitants.

1.1. PROJECT MAP



ETHNO-PROGRAM FOR CLIMATELY INTEGRATED WATER MANAGEMENT FOR THE NARAKAJMANTA INDIGENOUS COMMUNITY, IN COLOMBIA

	Project area
	Stationary and migratory bird populations
	NARAKAJMANTA indigenous settlements
	Birdwatching and hiking spots

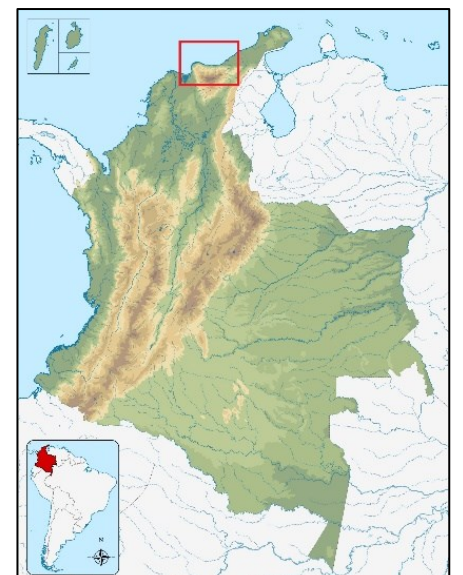
SCALE



SOURCES

- Environmental Women ORG
- Google Maps

- **Country:** COLOMBIA
- **Departments:** Magdalena
- **Cities:** Santa Marta
- 40,000 hectares of Narakajmanta indigenous territory
- **Geographic coordinates:** From 11°12'14.9"N 73°55'05.3"W and 11°11'40.9"N 73°26'37.7"W; to 10°57'41.6"N 73°54'13.9"W and 11°01'29.7"N 73°29'35.7"W



ANALYSIS OF EXPECTED RESULTS

The "Augmented Reality-Based Birdwatching Ecotourism" program presents a comprehensive vision to generate environmental, social, economic and cultural impacts in the Narakajmanta indigenous community. The expected results, outlined in quantifiable goals, allow for the evaluation of its viability, sustainability and replicability as a sustainable ecotourism model. The main aspects are analyzed below:



1. Environmental Impact

1.1. Habitat Conservation

The goal of restoring 2,000 hectares of critical habitats is technically ambitious but feasible. This action not only favors biodiversity, but also contributes to carbon sequestration, supporting the objectives of the Paris Agreement. However, its success will depend on:

- Constant financial resources, guaranteed by reinvesting 50% of tourism revenue.
- The effectiveness of environmental monitoring, supported by 20 camera traps and climate sensors, which offer key data on ecosystem recovery.

1.2. Protection of Key Species

The projected 15% increase in the population of avian species reflects significant progress, considering current threats such as deforestation and poaching. However, community collaboration will be essential to reduce the 40% of illegal activities, through conservation agreements overseen by local leaders.

2. Socioeconomic Impact

2.1. Income Generation

The 30% increase in family income within three years is a realistic goal, given the focus on:

- The commercialization of 10,000 units of handicrafts and gastronomic products annually.

- Tourist packages that will generate an estimated annual income of \$100,000 USD, diversifying the local economy. However, sustainability will depend on:

- A robust digital marketing strategy to attract at least 3,000 tourists annually.
- The implementation of competitive pricing policies that guarantee accessibility without compromising service quality.

2.2. Women's Empowerment

The creation of 50 direct jobs, with 60% occupied by women, and the development of 25 women-led enterprises, reflects a clear commitment to gender equity. This approach has the potential to transform the socioeconomic dynamics of the community, strengthening the role of women as agents of change.

3. Cultural Impact

3.1. Rescue of Traditional Knowledge

The use of cultural narratives in tours and the production of bilingual educational materials promotes the rescue and visibility of indigenous traditions. This not only strengthens cultural identity, but also adds a unique value to ecotourism, differentiating it in the global market.

3.2. Intergenerational Education

The training of 1,350 young people under 18 years of age ensures the transfer of knowledge and fosters a new generation of leaders committed to conservation. This reinforces the long-term social sustainability of the program.

4. Technological Impact

The integration of the augmented reality application, used by 70% of tourists, and the collection of 50,000 ecological data, positions the program as a reference in the digitalization of ecotourism. However, its success will depend on:

- Regular updates of the application to maintain its relevance and functionality.
- Continuous training of guides in the use of advanced technologies.

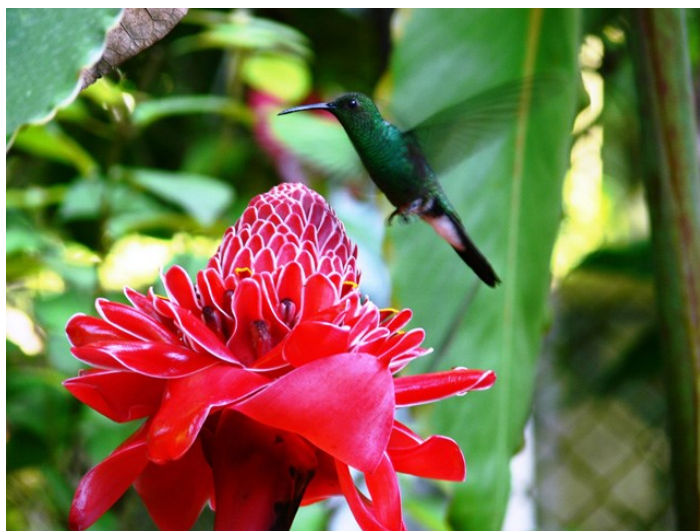
5. General Evaluation

The program presents a solid monitoring structure based on clear indicators, such as:

- Tourist satisfaction, with a goal of 90% positive ratings.
- Scientific publications derived from the data collected, which contribute to global knowledge on bird conservation. However, the results will be conditioned by:

- The effective implementation of community conservation agreements.
- The program's ability to adapt to challenges such as extreme weather events or fluctuations in global tourism.

The program establishes ambitious but achievable goals, supported by a comprehensive strategy that combines environmental conservation, economic development and cultural strengthening. If the planned monitoring, community participation and financial reinvestment mechanisms are implemented, the impact will be significant and sustainable. However, long-term success will require periodic adjustments and an adaptive approach to respond to emerging challenges. This model has the potential to become a replicable benchmark in other high biodiversity regions.



CONCLUSIONS

The program "Augmented Reality-Based Birdwatching Ecotourism" represents a comprehensive proposal that combines environmental conservation, economic development, and cultural strengthening in the Narakajmanta indigenous community, located in the Sierra Nevada de Santa Marta. Through the implementation of innovative technologies, environmental education, and sustainable strategies, the project seeks to generate tangible and replicable impacts at the local and international level.

1. Environmental Conservation and Biodiversity Protection

The program establishes a solid model for the restoration and conservation of critical habitats in a region of high

biodiversity. The goal of recovering 2,000 hectares and increasing by 15% the populations of key avian species such as the King Vulture (*Sarcoramphus papa*) and the Black-capped Owl (*Ciccaba nigrolineata*), demonstrates a technical and quantifiable approach to environmental sustainability. The use of monitoring technologies, such as 20 camera traps and climate sensors, ensures the generation of accurate data that contributes to both local conservation and global scientific research.

The implementation of community agreements to reduce illegal activities, such as poaching, by 40% reinforces the community's commitment to protecting its territory and biodiversity.

2. Socioeconomic Impact and Community Empowerment

The program creates a framework for sustainable economic development, directly benefiting 5,000 members of the Narakajmanta community. The diversification of income through ecotourism, with a projection of \$100,000 USD annually, and the 30% increase in family income in three years, reflects its capacity to transform the socioeconomic conditions of the region.

The focus on women's empowerment, with 50 direct jobs and 25 women-led ventures, strengthens gender equity and positions women as leaders in conservation and ecotourism. The training of 50 local guides, prioritizing women, guarantees the active participation of the community in all phases of the program.

3. Technological Innovation and Environmental Education

The use of augmented reality through a mobile application, designed to attract 70% of tourists, transforms the ecotourism experience, offering interactive and educational content on avian species. This innovation not only improves the visitor experience, but also positions the Sierra Nevada as a leading destination for technological ecotourism.

The training of 1,350 young people under 18 years of age and the production of 4 annual blogs and a mini-documentary promote intergenerational environmental education and ensure the transfer of knowledge to future generations.

4. Sustainability and Replicability

The reinvestment of 50% of tourism revenues in conservation activities and the creation of an indigenous ecotourism production chain guarantee the financial

sustainability of the program. This approach ensures that the economic, social and environmental benefits are maintained in the long term.

The program's methodology, based on clear indicators and constant evaluations, makes it a replicable model for other communities in regions of high biodiversity.

5. Contribution to Global Goals

The program is aligned with the Sustainable Development Goals (SDG), particularly:

- SDG 13 (Climate Action): Mitigating the impact of climate change by restoring habitats.
- SDG 15 (Life on Land): Promoting biodiversity conservation.
- SDG 5 (Gender Equality): Empowering women through leadership and income generation.

The "Augmented Reality-Based Birdwatching Ecotourism" program strikes a balance between conservation, innovation, and community development. Its comprehensive approach, based on data and community participation, positions it as an exemplary model of sustainability in the Sierra Nevada de Santa Marta. While the goals are ambitious, the combination of advanced technologies, environmental education and inclusive strategies ensures their long-term viability, with the potential to scale up to other biodiverse regions in the future.



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