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* **Corresponding author.**

Tel: 0057-1-316-8741625
castillomonica@unbosque.edu.co

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Birdwatching Tourism and Environmental Education as Strategies for the Conservation of Wetlands in the City of Bogotá, Colombia

Monica Andrea Castillo-Aguilar^{1*}, Virginia Roa-Angulo¹

¹ Biology Research Group-GRIB, Faculty of Sciences, Department of Biology, El Bosque University, Avenue 9 # 131a- 02, 110121, Bogotá, Colombia. Tel.: 0057-1-316-8741625

Abstract

Objectives: To present a theoretic proposal involving avitourism and environmental education that contributes to conservation and sustainability of the matrix between urban and natural areas focused in Wetland in Bogotá, Colombia. **Methods/statistical analysis:** Actor's analysis was carried out using semi-structured interviews and surveys. On-site visits were used to evaluate the current conditions for performing birdwatching activities at Tibabuyes-Juan Amarillo, Jaboque and Córdoba wetlands in the city of Bogotá. **Findings:** This work considers the connection among birdwatching tourism in wetlands, environmental education and education institutions. Strategies for the creation of environmental awareness in children and wetland sustainability are proposed, including the creation of interpretative pathways with guided tours, workshops, environmental activities and the possibility of volunteer work. **Applications:** Environmental and financial benefits could be obtained, with proper planning and management.

Keywords: Birdwatching Tourism; Conservation; Environmental Education; Sustainable Management; Wetlands

1 Introduction

The concept of wetland has several edges. The definition of the Ramsar Convention ⁽¹⁾ on Wetlands is one of the most used, favoring the conservation and proper management of these natural environments and highlighting the main function of water as a controlling factor of the ecosystem structure. Wetlands are ecosystems characterized by their great natural value. In the city of Bogotá, wetlands' high plant diversity, composed of trees and shrub species of terrestrial, aquatic and semi-aquatic habits, are home of more than 160 of native and migratory birds.

These are highly vulnerable environments in Colombia. Nature-society interaction has modified wetlands' dynamics, giving rise to changes in the coverage of the afferent basins and drainage. Activities such as wetland fragmentation have transformed water quality and altered the nutrient dynamics and seasonality of the system ⁽²⁾. These ecosystems are of vital importance, they are home to a high number of species.

Some endangered or threatened of extinction as a consequence of stratification and loss of habitat^(3–5), due to contamination and loss of water quality^(6,7), or the expansion of the urban border⁽⁸⁾.

However, wetlands provide the necessary conditions for the establishment of aquatic birds, where species richness and abundance depends on the hydrological regime, the size and heterogeneity of the site/area, and the structure of the vegetation. The high diversity of Neotropical bird species, together with diverse migratory bird's species, and latitudinal migrants⁽⁹⁾, favors the practice of birdwatching.

Birdwatching tourism is defined as the set of for-profit activities consisting of facilitating all kinds of people to observe birds in natural areas as a means of recreation, research and scientific development⁽¹⁰⁾. It is currently considered one of the most developed activities in tourism, with a growing market volume. Colombia stands out as a world birding destination due to its high probability of effective encounter and the great diversity of birds in reduced areas. Thus, the interest in birdwatching has become a tool for the conservation not only of birds but also of the ecosystems and environments in which they live, strengthening local development.

Environmental education seeks the care of the environment and the possibility of acquiring values, attitudes and skills necessary to protect and improve human life on the planet. Environmental education research has shown that changing human relationships with the environment requires an increasing knowledge about the environment that leads to changing human attitudes towards conservation⁽¹¹⁾. Environmental education has gained a importance over time: social, environmental and educational⁽¹²⁾ which, through different schools of thought, ideological and ethical practices, have allowed the construction of educational tools with vocation and integration of human development and reconciliation with the environment.

Mitigating impacts and contributing to biodiversity conservation is a great challenge in large cities, where the accelerated increase in urban settlement has diminished natural areas. The effects of large cities on the areas in which they develop are profound, substituting natural ecosystems and altering the original flora and fauna⁽¹³⁾. Consideration of strategies that promote local development by linking communities that integrate natural, social and human components⁽¹⁴⁾, can be a tool that favors the conservation of birds and natural environments, generating socio-economic and participatory benefits.

2 Methods

Contact was made with the entities in charge of wetland management, “Empresa de Acueducto y Alcantarillado de Bogotá” (EAAB) and “Secretaría Distrital de Ambiente” (SDA) to have access to three wetlands of the Bogotá city: Tibabuyes-Juan Amarillo, Jaboque and Córdoba. The author's made tours accompanied by officials or groups of bird's watchers. During the tours, each bird observed was recorded. The diversity of birds was estimated to explore the probability of encounters with the avifauna and the diversity of birds with a sampling effort of 56 man/hours.

The authors defined six groups of people for the development of the stakeholder matrix. Wetland visitor: those who attend the wetland with an interest in knowing the place, wetland neighbors: people who live nearby; birds watchers: interested in spotting wetland birds; EAAB workers: workers in charge of maintaining the wetland; Overseers of Popular Action - H. de Córdoba: defender of environmental actions of the Wetland Córdoba, to know the perspective on wetlands, conservation, environmental education and bird tourism, through using nine semi-structured interviews and seven surveys for wetland. With the interviews and surveys collected information regarding people's perception of the environmental education, activities and birdwatching. The authors developed a reflective proposal of birdwatching tourism and environmental education as strategies for the conservation of the Bogotá wetlands.

3 Results

Stakeholder matrix

The stakeholder matrix (Table 1) allowed the identification of interests and highlighted the problems from the point of view of each actor according to their relationship with wetlands.

Table 1. Stakeholder matrix in the three wetlands, Tibabuyes-Juan Amarillo, Jaboque and Córdoba

Groups	Interest	Perceived problems	Agreements and resources
Visitors	Guided tours Safe and quiet routes Connection with nature	Insecurity when visiting wetlands Lack of accompaniment Lack of information on time tables, workshops and guided tours Inadequate roads	Reinforcement of security in the area Presence of a continuous environmental facilitator
Birds watchers	Develop routes defined for visitors according to avifauna experience Develop a proposal that prevents the deterioration of wetlands	Lack of bridges and crossings that facilitate the passage between aquatic areas Good signaling of wetland interactions and biological function	Appropriate proposals with little landscape intervention Design of informative panels
Wetland neighbors	Signals information to learn more about the ecosystem and species Safety and good lawn management	Ignorance of the functioning of wetlands as ecosystems Insecurity and vandalism Vegetation management	Workshops design of ecosystem unction Reinforcement of security in the area
EAAB workers	Good water quality Improve erroneous water connections	Erroneous connections between canals and wetlands Clogging and bad smells Excess organic matter	Analysis of water management programs? and educational campaigns
Guard of the zones	Ensuring security in wetlands Proper handling of feral dogs	Insecurity and support from the National Police security with enclosures Presence of feral dogs	Reinforcement of security in the area
Overseers of Popular Action - Wetland. Córdoba	Presence of environmental skilled facilitators Neighboring groups of people interested in birding activities	Difficulty in communication channels with EAAB Neighbors and visitors who are not very sensitive to the wetland	Presence of a continuous environmental facilitator Raising awareness among visitors

Source: The authors

Tibabuyes-Juan Amarillo, Jaboque and Córdoba wetlands have corridors delimiting the area of the water, on which paths have been designed in a rustic manner, being the areas used for birdwatching visits. The Córdoba wetland has an elevated path of 1.2 km that facilitates and systematizes almost all visits. The Tibabuyes-Juan Amarillo and Córdoba wetlands have administrative headquarters for contact and organization of visits. All the wetlands have signs for birdwatching and information about the District Ecological Parks and viewpoint zones for birdwatching.

Bird diversity and abundance

From the visits carried out, we obtained a list of birds observed (Table 2). Córdoba wetland, despite being the smallest (40.4 ha) is present the greatest bird diversity, with 41 *spp.* compared with 25 and 26 in the other wetlands. The higher *spp.* diversity is probably explained to the role of engaged community of neighbors. For 17 years the neighbors have actively participated in the protection, management and conservation. Through a legal action (Popular Action 00-254 of 2000), they have been able to be actively involvement in the management and planning of environmental activities carried out in this wetland.

Table 2. List of birds observed in the wetlands Tibabuyes-Juan Amarillo, Jaboque and Córdoba

Scientific name	Common name	Wetlands		
		Juan Amarillo (222 ha)	Jaboque (140 ha)	Córdoba (40.4 ha)
<i>Anas discors</i>	Canadian duck	✓	✓	✓
<i>Ardea alba</i>	Grey heron	✓	✓	✓
<i>Bubulcus ibis</i>	Cattle heron	✓		
<i>Butorides striata</i>	Green heron		✓	✓
<i>Calidris melanotos</i>	Pectoral sandpiper			✓
<i>Megascops choliba</i>	Tropical Screech-owl			✓
<i>Coccyzus americanus</i>	Yellow-billed cuckoo		✓	✓
<i>Colibri coruscans</i>	Sparkling violet-ear	✓	✓	✓
<i>Contopus cinereus</i>	Southern tropical pewee			✓

Continued on next page

Table 2 continued

<i>Coragyps atratus</i>	American black vulture	✓	✓	
<i>Crotophaga major</i>	Greater ani			✓
<i>Chrysomus icterocephalus</i>	Yellow hooded blackbird	✓	✓	✓
<i>Diglossa humeralis</i>	Black flowerpiercer	✓	✓	✓
<i>Elaenia frantzii</i>	Mountain elaenia			✓
<i>Elanus leucurus</i>	White-tailed kite	✓	✓	
<i>Forpus conspicillatus</i>	Spectacled parrotlet			✓
<i>Fulica americana</i>	American coot	✓	✓	✓
<i>Gallinula galeata</i>	Commun gallinule	✓	✓	✓
<i>Gallinula melanops</i>	Spot-flanked gallinule	✓		
<i>Icterus chrysater</i>	Yellow-backed oriole		✓	✓
<i>Icterus nigrogularis</i>	Yellow Oriole		✓	✓
<i>Lesbia nuna</i>	Green-tailed trainbearer			✓
<i>Molothrus bonariensis</i>	Shiny cowbird	✓	✓	✓
<i>Nycticorax nycticorax</i>	Black.crowned night.heron	✓	✓	✓
<i>Oxyura jamaicensis</i>	Ruddy duck	✓	✓	✓
<i>Ochthoeca fumicolor</i>	Brown-backed chat-tyrant			✓
<i>Phalacrocorax brasilianus</i>	Neotropical cormorant	✓	✓	✓
<i>Pheuticus aureoventris</i>	Bababuy			✓
<i>Phimosus infuscatus</i>	Bare-faced ibis		✓	✓
<i>Piranga rubra</i>	Summer Tanager			✓
<i>Pitangus sulphuratus</i>	Great kiskadee	✓	✓	✓
<i>Podilymbus podiceps</i>	Pied-billed Grebe	✓		✓
<i>Rupornis magnirostris</i>	Roadside Hawk			✓
<i>Setophaga fusca</i>	Blackburnian Warbler		✓	✓
<i>Sicalis flaveola</i>	Saffron finch		✓	✓
<i>Spinus spinescens</i>	Andean siskin	✓		
<i>Thraupis episcopus</i>	Blue-grey Tanager	✓		✓
<i>Thraupis palmarum</i>	Palm Tanager	✓		✓
<i>Tringa solitaria</i>	Solitary sandpiper	✓		✓
<i>Turdus fuscater</i>	Great Thrush	✓	✓	✓
<i>Tyrannus melancholicus</i>	Tropical kingbird		✓	✓
<i>Tyrannus savana</i>	Fork-tailed flycatcher			✓
<i>Tyrannus tyrannus</i>	Eastern kingbird	✓		✓
<i>Vanellus chilensis</i>	Southern lapwing	✓	✓	
<i>Vireo olivaceus</i>	Red-eyed Vireo			✓
<i>Zenaida auriculata</i>	Eared dove	✓	✓	✓
<i>Zonotrichia capensis</i>	Rufous-collared Sparrow		✓	✓
		25	26	41

Source: Own preparation

Sustainable Management of birdwatching Tourism in the Wetlands of the city of Bogotá

The proposal contains three main actions (Table 3), focusing on improving the physical infrastructure, strengthening environmental activities and increasing economic resources.

Table 3. Actions and activities for the project Sustainable Management of birdwatching in the Wetlands in Bogotá city

Infrastructure and physical aspects	Strengthening of environmental activities	Economic resources
<ul style="list-style-type: none"> • Roads • Sighting towers and viewpoints • Signals • Security and enclosure • Ecological flows and water mirror cleaning • Removal of invasive vegetation • Extraction of solid waste and rubble 	<ul style="list-style-type: none"> • Water quality monitoring • Interpretative sighting trails • Volunteer Programs • Environmental Facilitator Volunteer Programs • Training of personnel 	<ul style="list-style-type: none"> • Offer of workshops and environmental activities • Preliminary analysis of load capacity • Sale of informative material

Source: The authors

The proposal considers in its first action the need to improve infrastructure, environmental quality and safety to ensure the tranquility of visitors and the use of environmental services provided by these ecosystems. For the second action, the opportunity was to strengthen environmental activities through monitoring and follow-up of water quality, and the layout of interpretative trails. These trails are considered as educational tools that can be used in natural areas to integrate social groups to conservation processes through environmental education. Hence, these trails allow visitors to come into direct contact with the values of the environment⁽¹⁵⁾.

Birdwatching activities require displacement by those interested. We propose the development of structures that facilitate mobility and the use of areas of high visibility. These structures will have more extensive sightings areas. Therefore we suggest the use of sighting towers, trails and viewpoints in open areas [Figure 1](#) to favor observation at a greater distance. We designed routes based on the experience of bird-observation visitors. They consist of two types of routes with the use of ramps and/or connecting bridges in the critical points to facilitate the passage of the visitors [Figure 2](#) and to be used by people with movement restrictions.

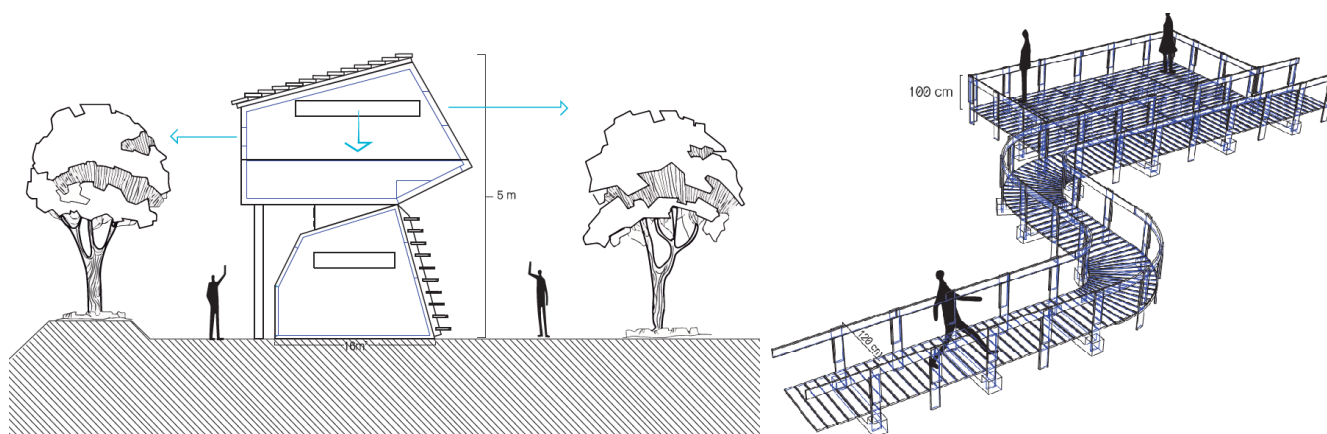


Fig 1. Plans of the proposed sighting towers, trails and viewpoints. Designed in Adobe illustrator CC[®]

- Beginner routes: 2 to 4 km routes, simple terrain and open areas with easy birdwatching areas, with viewpoints and sighting towers
- Advanced routes: 4 to 10 km long routes and more difficult roads given by the systemic complexity of the wetland for people who have birdwatching expertise.

For the proper development of these strategies, the presence of environmental facilitators is important. The facilitators should be people trained and committed to the development of activities including those related to social participation and identification of possible socio-environmental impacts. Facilitators should be considered as proactive individuals for the good of the community and the environment. It is important to offer workshops and environmental activities as part of the sustainable development through environmental education. These educational activities contribute to the progressive transformation of human's attitude towards the environment. Workshops are proposed with specific topics such as: Initiation in Bird Observation, Citizen Environmental Culture, Nature and Landscape Photography, Environmental Awareness and Conservation, Sustainable Use of Natural Resources, Migratory Birds and Wetlands.

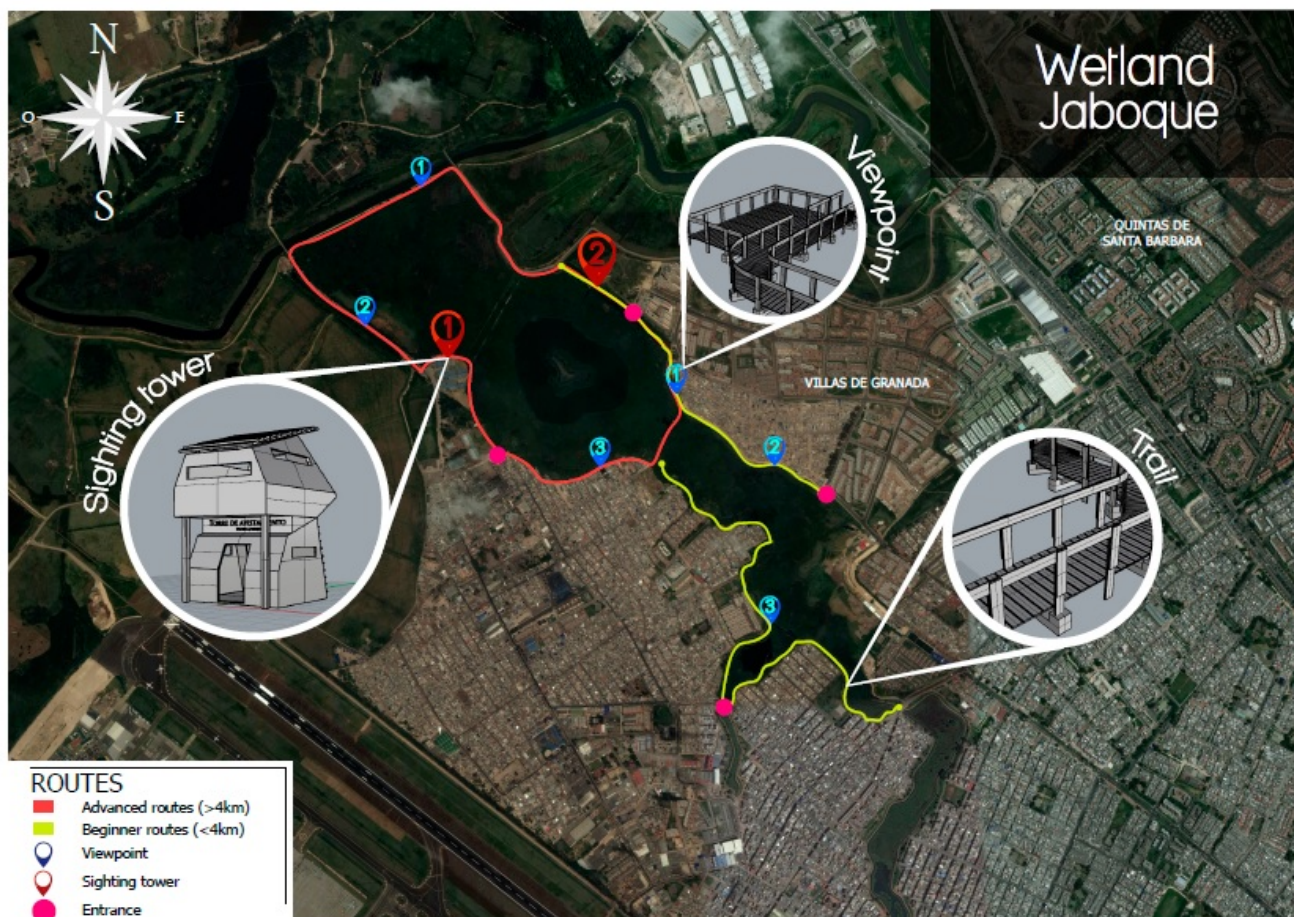


Fig 2. Map of Jaboque wetland with location of trails, viewpoints and sighting towers, 3D representation developed in Rhinoceros 5.0.

Likewise, a volunteer program is proposed through the creation of social movements driven by solidarity that is directed towards the support of problem solving. Volunteers are one of the most active and profound aspects of citizen participation in our contemporary society and are born of the free and disinterested assumption of personal and social responsibility⁽¹⁶⁾. These programs are considered social participation strategies that contribute to the benefit of the community. The third action suggests activities that contribute to the increase of financial resources, which can be allocated for site improvements and/or activities that favor visitors. It also relates and brings visitors closer to wetlands and birdwatching tourism practices.

4 Discussion

The wetlands of the city of Bogotá present problems of environmental degradation generated by the dynamics of urban growth associated with changes in land use. Among the problems highlighted by those involved is the lack of accompaniment and lack of information on schedules, workshops and visits that can be made, as well as ignorance about wetlands as transcendental ecosystems in the urban matrix, generating interest and concern from environmental management, by increasing their vulnerability and deterioration.

Birds observed in the wetlands make possible to analyze the level of conservation of these ecosystems, given their role as indicators of environmental quality, due to their sensitivity to noise and environmental pollution⁽¹⁷⁾. They can also indicate some habitat characteristics and their presence or absence helps to understand patterns of environmental impacts⁽¹⁸⁾. Córdoba wetland has a better environmental quality not only because of the number of birds observed, but also because of the absence of invasive vegetation and the presence of an ecological flow that favors the constant flow of water, reducing the concentration of organic matter, activities reached by the protection action decreed.

Of the 188 species recorded in three Bogotá wetlands, 65 are migratory species (35% of the total), constituting an important proportion of the avifauna in the city's Wetland District Ecological Parks-PEDH⁽¹⁹⁾. Birdwatching tourism is available throughout the year, offering the possibility of encounter with birds during the different climatic seasons. Socialization of the viability of observing birds with a high percentage of encounters, for those interested and for experts in birdwatching, becomes a tourist attraction that needs to be published through massive communication channels (web pages) and through groups of ornithologists and people interested in birds.

Birdwatching tourism requires displacement on the part of the interested parties, structures are proposed that facilitate the mobility and the advantage of zones of wide visibility. Interpretative trails are an attractive strategy that benefits natural areas by generating economic returns that can be invested in each wetland for management and conservation, promoting environmental value among visitors and neighbors.

Including volunteer programs in the sustainable management plan for birdwatching tourism in the Bogotá wetlands would generate links between entities and citizens, favoring the monitoring and conservation of natural areas. Likewise, linking people motivated to help selflessly creates a positive social and environmental impact. It is proposed to establish contact with educational institutions to generate a participation agreement and fulfill the commitments of the Environmental Education Policy of the National Environmental System -SINA, which includes the environmental dimension in formal education⁽²⁰⁾, through School Environmental Projects -PRAE.

The PRAE respond to the mandate stipulated by Law 115/1994⁽²¹⁾, which establishes the General Education Law, defining environmental education as a mandatory subject in public and private educational institutions. It seeks to respond to the need to acquire awareness of conservation, protection and improvement of the environment, quality of life, rational use of natural resources and disaster prevention.

As a value aspect of the project, positive scenarios are proposed that could be generated by its development:

- Improvement in the biological conditions of the aquatic system and recovery of the natural conditions of the wetlands: The removal of invasive vegetation, the construction of ecological flows, the removal of solid waste and debris, and water quality monitoring would improve the natural conditions of the wetlands, promoting the natural processes of recovery and natural succession of ecosystems.
- Contribution in the conservation of wetlands and birdlife: The conditions planned for the offer of birdwatching tourism in the three wetlands of Bogotá, would favor the conservation and protection of these ecosystems, if the number of visits is adequately managed.
- Government entities driven to improve the quality of natural ecosystems within cities: It has the advantage of the commitment of institutions to improve the quality of natural resources in the ecosystems within the city through the financial resources of these entities.
- Increased interest and programmed visits to wetlands for birdwatching tourism purposes: The offer of organized plans, with adequate infrastructure and security, would improve and increase the number of visits of different interest groups.
- Participation of citizens in volunteer programs: Volunteer programs allow for the approach between the social and environmental components of the city. To offer the possibility of training, gaining experience and giving voluntary work to the care of natural ecosystems, is to open a window to new proposals favorable to the natural environments of the city.
- Increase in financial resources for each wetland that would allow a reinvestment for the continuation of the project: The sale of quality ecotourism services, which guarantee safety conditions for tourists and visitors, favor the maintenance in time of the birdwatching offer and the acquisition of economic resources. Likewise, the sale of information material of birdlife in Colombia is within the texts of interest and high rotation.

In order to carry out the proposal, the support of the public companies of the city such as EAAB, responsible for the management and maintenance of the water resource and SDA, in charge of trail management, vegetation and administration of the Wetland District Ecological Parks-PEDH of the city is proposed. With the participation of these institutions and the articulation of a bidding company responsible for the proposed actions and activities, the aim is to improve wetland conditions for the development of environmental education activities. Their participation in the conservation and protection of these ecosystems through birdwatching tourism contribute to the creation of responsible environmental behavior through participatory ties and social responsibility.

5 Conclusions

The stakeholder analysis made it possible to highlight the interests and define the problems of the wetlands from the perspective of each actor, favoring the global analysis of this work and orienting the three actions and activities proposed for the Sustainable Management of Birdwatching in the Wetlands of the city of Bogotá project.

Birdwatching tourism was analyzed as a practice that contributes to the conservation of wetlands, through the analysis of current conditions, the effectiveness of birdwatching and the number of species observed.

The wetlands of the city of Bogotá require rapid intervention to ensure their conservation; this work addressed the option of offering activities involving citizen participation with social responsibility and environmental education, with emphasis on children.

Positive scenarios are presented on the relationship between birdwatching tourism and wetlands from sustainable management as strategies for the conservation of wetlands in the city of Bogotá.

The reflective proposal presented in this paper seeks to contribute to the conservation of wetlands, linking society as the main support to achieve change in the current perception of the wetlands of the city of Bogotá, through the relationship between wetlands, birdwatching tourism, society and environmental education.

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