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PHASE 2- CITIZEN SCIENCE PROCESS IN THE POLITÉCNICO GRANCOLOMBIANO UNIVERSITY CAMPUS AND EASTERN HILLS FOR THE IDENTIFICATION OF HERPETOS, AVIFAUNA AND ARTHROPOFAUNA

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Abstract: The project in its ongoing phase 2 examines and enhances this rich biodiversity by identifying and cataloging the species of herpetology, avifauna, and arthropofauna present in the area of the eastern hills. The main objectives include not only the identification of species, but also raising awareness among students and the local community about the importance of nature conservation, such as the protection area of the main ecological structure. Biodiversity plays a crucial role in maintaining ecosystems and promoting ecological health, particularly in the university campus and the eastern hills. These areas, rich in biodiversity, face important conservation challenges, such as increasing urbanization and pollution. During this phase 2 of the project, various activities will be carried out in collaboration with the community of the Chapinero Locality. These activities include counting species of herpetology, avifauna, and arthropofauna using computer tools and geographic information systems. This is done in order to carry out an exhaustive monitoring of these systems that are threatened by global climate change, with a particular focus on the area of influence of the campus of the Grancolombiano Polytechnic University Institution.
Keywords: Territory, sustainability, environmental management, citizen science

INTRODUCTION

Biodiversity, a fundamental part of the ecological balance and sustainability of our planet, faces increasing threats from human activities, rapid urbanization, pollution and climate change. In this context, citizen science is emerging as a powerful tool to mobilize citizens around nature conservation. The phase 2 project that we propose at the Institución Universitaria Politécnico Grancolombiano Campus, in collaboration with the communities of the Cerros Orientales, aims to strengthen this citizen engagement through the collection of data on herpetological species, avifauna and arthropofauna (Garzón, 2014).

Open science is a philosophical movement that advocates that the results of scientific research, i.e., the data obtained and the hypotheses tested, should be disseminated online in such a way as to promote free access and collaboration between scientists from different areas of knowledge.

Citizen science is the model by which scientists from different backgrounds establish joint learning and knowledge feedback processes among communities that are not experts in the field. The solidarity of thousands of people recording different aspects of nature has a value that could hardly be achieved by a body of professionals, no matter how large and perfectly prepared it may be. Scientific field activities carried out by civil society are fundamental for the generation of knowledge and for the valorization of natural resources.

In the first phase of the study, it was possible to observe and analyze various problems in the community, of which two in particular stand out. The first of these is the loss of biodiversity in the eastern hills of Bogota, especially with regard to birds and herptiles. The study of strategic ecosystems and their management is essential to be able to make informed and sustainable decisions regarding the conservation of the environment to the territory and the preservation of our main ecological structure.

The lack of appropriation of the areas near and around the university also contributes to the threat of urban and anthropogenic pressure on some species. This problem has become a serious threat to these species mainly due to the lack of knowledge about them and the lack of awareness about the importance of preserving their habitat (Capador Aguilar et al., 2021). Many people are unaware that these hills are home to a large number of birds and herptiles of high ecological value, which has led to the neglect of the necessary conservation measures.

The rich biodiversity of the Cerros Orientales is exceptional, but little known. The following work is proposed in order to establish a methodology for the Citizen Science Process (CC) to promote the identification, classification and monitoring of herpetofauna, birds and macrofauna (spiders, insects and other invertebrates) found in areas of interest to biodiversity, especially sites such as: the Politécnico Grancolombiano University Campus, the Bosque Oriental Protected Forest Reserve of the Mayor's Office of Bogotá and the surrounding area. This identification, classification and monitoring will be carried out through the contribution of information to the geographic information systems established in parks, water sources and surrounding areas of the university campus, by means of the programs developed from the geographic information obtained. This methodology, to be applied in different scenarios of the country and eventually at international level, will establish the bases and strategies for the identification, utility of geographic information systems and the consolidation of a virtual platform. Through this project we intend to educate citizens, inform them about the biological diversity that surrounds them and encourage a proactive conservation attitude (Moncada Álvarez et al., 2018).

DESIGN AND METHOD

The methodology adopted for this project is based on a mixed citizen science approach (quantitative and qualitative) (Meza, 2008).

Transactional sampling was used to collect data on vertebrates. Sampling was carried out twice a day, from 09:00 to 11:00 hours and from 14:00 to 16:00 hours during two months, the months of March and April 2024, except for the Field Induction Workshop, which was carried out in February. For the sampling of the avifauna group, a fixed sampling route of approximately 4.5 km in length was prepared, located at the Politécnico Grancolombiano University Campus towards the eastern hills of Bogotá.

Two walking tours per week were conducted to record landbirds, arboreal birds, and aquatic birds. During each of the walks, participants were organized into three groups: in the first group were people with the sole purpose of recording birds by listening and information of the passage of birds without photographing; in the second group were participants who were able to identify species of birds by listening and also took the photographic record of the birds by digital camera or cell phone; and in the third group were environmentalists and biologists experts in ornithology, whose purpose was to guide the first two groups about different behaviors and information of the species observed. During the trip, frequent stops were made, allowing all groups to observe, photograph and be attentive to the development of birds in colonies, nests and courtship. In addition, each time a bird species was sighted, it was recorded in a mobile application. In addition, this application allows temporal and spatial indexing of the records made.

SELECTION OF STUDY AREAS

This project was carried out to protect the natural systems and natural ecosystems of the surrounding areas and within the Institución Universitaria Politécnico Grancolombiano, to know the variations in nature, ecological niches and citizen science, are mainly due to the lack of knowledge of the species that coexist on campus especially avifauna and herpetos, especially environmental conservation areas that are being affected by deforestation, anthropic conditions and climate change, remote sensors (camera traps, satellite images, Inaturalist, ArcGis) allow participation and constant data collection to generate early warnings and be able to make decisions or reports to the corresponding authorities especially for endangered species (Collazos-González et al., 2020; Gómez et al., 2022). Colombia has signed international agreements that require it to protect and conserve strategic ecosystems,

the green growth policy, the Aichi goals and the Sustainable Development Goals, and the biodiversity agreements, among others (Paula Rosana Bilder, 2008). These strategies seek to preserve these unique natural ecosystems (moors, wetlands, rivers, lagoons, estuaries), it is important to be able to collect reliable environmental data on birds and amphibians especially, but if we are successful it could be extended to other species such as small mammals and flora (Jiménez Mora et al., 2023). This is the only way academia can make decisions to report and protect the environment. High concentrations of species have repercussions on knowledge, species protection and the prevention of ecosystem destruction. That is why better environmental monitoring is required, particularly in these areas (Velasco-Belalcazar et al. 2023). The data that will be collected will be the geographic basis for adequate protection measures.

Citizens and students were encouraged to participate not only in data collection, but also in project design and analysis of results. This participatory model made it possible to create a collaborative learning environment where academic expertise blended with local knowledge.

IDENTIFICATION AND REGISTRATION PROCEDURES

Registration of birds: For the registration of birds in the study area, field trips were conducted in the eastern hills of the municipality of Bogota D.C.. Different structures, covaderas and nests were observed to identify the groups of birds present in the area, whose presence is recorded in the Grancolombiano Campus. The walking time in the intervention area was about 9 hours distributed in three days in which different ecosystems were sampled. Additionally, photographs were taken of the individuals posing on the power lines at the University Campus.

To record the species of herps, birds and arthropods in the study area, direct observation strategies were used, using binoculars and cameras to obtain digital evidence of the different behaviors and nesting structures of the species observed.

PARTICIPATION OF THE UNIVERSITY COMMUNITY

In the university context, the criteria of the coordination team was the selection of teachers and students belonging to the disciplines of environmental management technology and related programs, with interest in the development of citizen science activities and in the recognition of the wild biodiversity of the Capital region. This initiative was intended to integrate the student community in research and university extension activities, highlight the biodiversity of the study areas and generate a sense of belonging to the areas of influence among the student public. These actions were carried out thanks to the support of free databases, the directives of the Politécnico Grancolombiano at the time and the project team that led these initiatives. The activities directed to students and professors were carried out under a guiding approach with the purpose of promoting the valuation, knowledge and protection of the local fauna, also to promote harmony and coexistence of the university community with wildlife. This proposal considers that the Politécnico Grancolombiano has architectural specifications associated with green spaces and the topography of the campus. These specifications establish that the environment is designed to favor the comfort and protection of amphibians, reptiles and birds. Community resources and support: It is widely recognized that environmental and biodiversity research requires the support of a wide range of people and institutions. These range from students and intellectuals to park rangers and locals in general, as well as experts in the areas of stationery, transportation and communications.

FIELD WORK AND DATA ANALYSIS

This project in its second Phase 2 aims to carry out an exhaustive monitoring of species, focusing especially on birds and herptiles that are habitual residents both in the hills of Bogota and on the campus of the Institution. The purpose of this monitoring is not simply to list the species, but to enrich the processes of education and endogenous development, establishing a vital bridge between people and nature.

Students are a priority. In phase 1 they have had the opportunity to learn in a holistic manner, addressing topics such as environmental land management, risk management, ecosystems and production, always with a perspective focused on the conservation of protected areas.

In terms of education, informative sessions were organized, especially in the environmental culture and management courses, in the cross-cutting courses to share the findings with young people, thus creating awareness among the new generation and community commitment.

This is mainly due to the lack of knowledge about the species that coexist on campus, especially birds and herps. Remote sensors such as camera traps, satellite images, Inaturalist and ArcGis allow participation and constant data collection to generate early warnings and make decisions or report to the corresponding authorities, especially for endangered species.

The main objective of Citizen Science is participation: The idea here, the deeper the participation, the greater the transformative potential towards the understanding of nature. Some applications that we can find are: eBird: application of the Massachusetts Institute of Technology of the United States MIT, created for citizen science and bird identification, where people freely interact and take pictures and sounds of the bird species of the territory iNaturalist: Application created for that all people identify natural species, in real time, citizens interact with experts from around the world to understand the behavior of natural species. Through the data collected, it will be possible to establish a geographical basis to implement appropriate measures for reforestation protection, anthropic conditions and climate change. Therefore, the use of innovation and participation tools.

HYPOTHESIS QUESTION

Is it possible to detect endemic species in our locality through environmental monitoring of avifauna, herpetofauna and arthropofauna using citizen science and ICTs?

The data collected will be the geographic basis for implementing appropriate measures to protect the natural system and mitigate the risks arising from climate change. In addition, students will be able to integrate the knowledge acquired in areas such as environmental land-use planning, risk management, ecosystems and production, and apply it from the perspective of protected areas. Thus, from the academy, they will be able to generate solutions and proposals that contribute to environmental conservation and sustainable development in the country.

RESULTS AND DISCUSSION

The main results of the second block of activities are divided into identification of herpet species, avifauna species, number of evidences and number of arthropod species. As a transversal axis in all the results obtained, it was fundamental to make alliances with other collectors, especially from the surrounding community.

In the total number of herps, 15 individuals and 4 species were found in the total number of outings. In five of five outings, rain frogs (Breviceps adspersus) and common green frogs (Pelophylax perezi) were found, 56.6% of the total number of species found; 1 (26.1%) species of savannah snakes (Atractus crassicaudatus). In avifauna, a total of 15

evidences of 10 identified species were found. For the first strip of exits a total of 15 species were found, in the second 5, in the third a total of 14 species sighted and 5 for the fourth and last of this block. In the characterization of the conservation status, the number of species increases to 21, due to the addition to the species list of the category of inadequately known and poorly recorded, and to the list of species of lesser concern.

DIVERSITY OF IDENTIFIED SPECIES

The study area covers a sector of the hill "El Cable" located in the eastern sector of Bogota, between the neighborhoods Juan XXIII, Chapinero Alto and El Castillo. It is a portion of the hill that has survived isolated from the Cerros Orientales system and its annexation or the presence of human populations forced the destination to its areas of undoubted natural wealth. This area has been classified ecoregionally as part of the main ecological structure that make up the system of hills of Bogota that extends over the Eastern Cordillera and the savannah with two subunits north of the basin of the Bogotá and Tunjuelito rivers.

SPATIAL AND TEMPORAL DISTRIBUTION OF SPECIES

In order to establish the distribution process of the fauna and flora present within the Politécnico Grancolombiano University Campus, a survey of its biodiversity was carried out, focused on the study of transparently under the roofs of its different buildings and the investigation of the vegetation relicts present under them or in plots established in green fields, through the Scenario Registration methodology. These findings were complemented with the neighborhood report of this species report by the system of wetlands and eastern hills, as a response of the fauna and flora of these features to improve and reach the strategic habitats.

As a result, 17 different physiognomies and conservation statuses were found according to the existing management plans. The only one with characteristics of herbazal and verdegral in the area of influence, which allows it to maintain some individuals of herpetofauna and representative biodiversity.

Results of field trips and participation of students and the community.

Figure 1 Citizen science stakeholders

Note : authors 2024

Figure 1 shows the work with the community for citizen science, where sustainability and habitat protection issues were addressed.

HERPETOFAUNA IDENTIFICATION

Number of species identified: To date we have identified a total of 5 species of amphibians and 1 reptile.

Pristimantis spp. (Rain frogs, usually including several species within the genus).

CULEBRITA SABANERA

Sampling areas: The main target areas for identification include the eastern hills and the chapinero area north of the polytechnic.

- Sampling methods: Use of photographs and direct observations in their habitat.
- Herpetofauna: Number of identified species 5

To date, we have been able to identify a total of 6 species of herpetofauna, of which 5 are amphibians and 1 is a reptile. This diversity, although not extensive in number, reflects an interesting ecological variability and may be an indicator of the state of health of the ecosystem in which we find ourselves.

Figure 2 Flora and fauna management workshop in the Eastern Hills

Note: Authors 2024

Figure 2 shows evidence of community work and direct species identification.

Reptiles: Savannah snake snakes

This reptile is a common inhabitant of semi-open areas and is often mistaken for larger snakes. Its diet consists mainly of small invertebrates . The identification of this species in our sampling not only adds to the richness of the local herpetofauna, but also suggests the existence of a healthy ecosystem that can support predators such as this little snake.

SAMPLING AREAS

The areas selected for sampling are the eastern hills and the Chapinero area, located in a region with high biodiversity. These areas represent varied ecosystems ranging from montane forests to high humidity habitats.

Figure 1 shows the participation of stakeholders in the characterization of natural species.

Figure 3 Identified sabanera snake snake

Note: Authors 2024

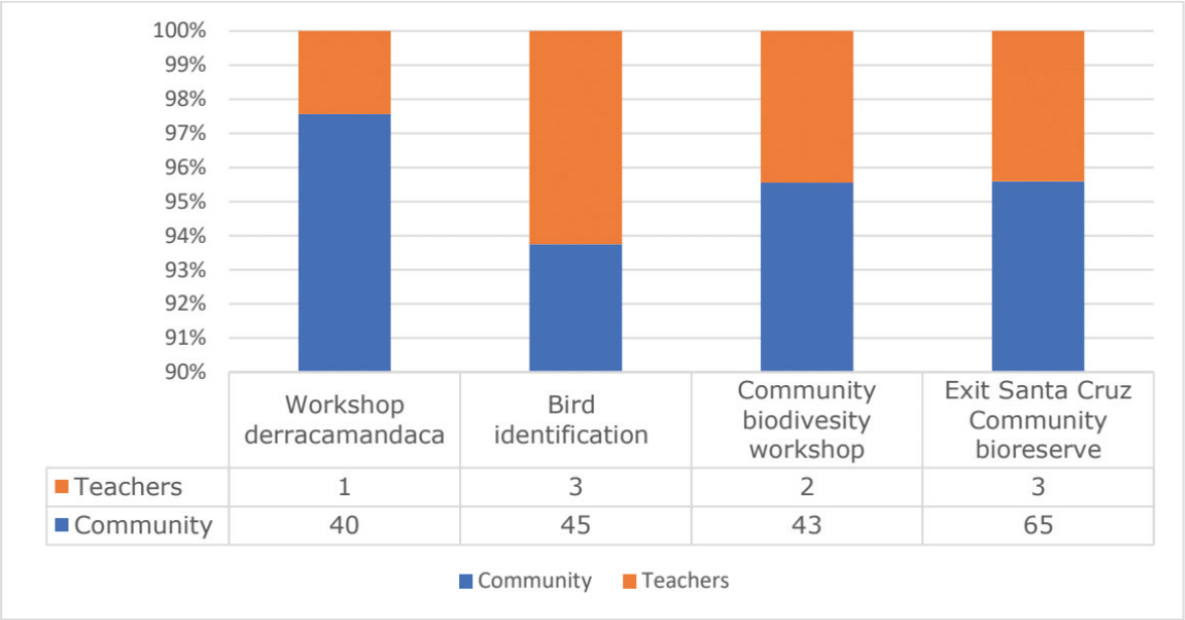
Figure 3 shows the Cerulean grasshopper snake identified in the northern area.

Challenges and opportunities

Monitoring herpetofauna is not without its difficulties. Urbanization, deforestation and climate change are factors that threaten these species. The role of environmental education is vital, the diversity of species, together with the sampling methods implemented, provides valuable information for the conservation and management of biodiversity.

IDENTIFICATION OF AVIFAUNA

- Species sighted: So far, these bird species have been recorded, with notable sightings including Torcaza (Zenaida auriculata), Copetón (Zonotriccia capensis), Colibrí chillón (Colibrí coruscans), Gallinule / Chulo (Coragyps atratus), Black-winged Blackbird (Turdus fuscater), Coal Tit (Diglosa humeralis), White-winged Goldfinch (Spinus psaltria), Long-tailed Hummingbird (Lesbia nuna), Flycatcher (Mellisuga helenae).
- Habitat: Bird populations appear to be more present in dense wooded areas during the breeding season, while open habitat species predominate near campuses.



Graph 1 Workshop and training participants

Note : Authors 2024

- Citizen awareness: More than 40 participants were trained to identify bird species, increasing community participation in the global big date 2024-1 project (https://www.poli.edu.co/noticias/el-poli-se-unio-al-global-big-day--2024-para-la-identificacion-de-aves--en-el-campus).

HABITAT

Observations made as part of our project show a clear trend: bird populations appear to be more active in densely forested areas, especially during the breeding season. On the other hand, some species, such as the Cape Serin (Serinus canarius), prefer open habitats, typical of urban areas and university campuses. These spaces offer varied food and sun exposure, favorable for feeding and social behavior of the birds.

IDENTIFICATION OF ARTHROPOFAUNA

Samples collected: We collected a total of 15 samples of insects, arachnids and crustaceans.

Figure 4 arthropods identified in the study area

Note : Authors

Figure 4 shows some arthropods identified with their biotic relationships, comet butterfly related to its ecological niche white oak.

IMPORTANCE OF CITIZEN SCIENCE IN BIODIVERSITY CONSERVATION

The city of Bogota has a wide biodiversity, represented in wild animals and is among the 12 biodiverse cities in the world. Although it has allowed the strengthening of plans, programs and campaigns for knowledge, protection and conservation of biodiversity, there are multiple challenges around the meeting of inclusive and open scenarios for promotion.

The District Secretariat of the Environment, Subdirectorate of Environmental Knowledge, from the Ecosystems Directorate, promotes Citizen Science practices in the city, which become a tool that allows joining synergies between different actors in the field of education, environmental, research and decision making in this area, strengthening the consolidation of the city as a smart city and the development of citizen capacities for the construction of a sustainable environment. In addition, the city of Bogota has ecologically important scenarios of located at the foothills of the eastern mountain range that deserve to be studied as a focus for biodiversity monitoring. A clear example of this is the Politécnico Grancolombiano University Campus, which is located on a biological corridor on the edge of the former Forest Reserve.

The eastern hills of the city of Bogotá are an important geographical landmark as a mountain range, located on the western slope of the eastern mountain range. The chain at moderate altitude provides oxygenation to the city, while protecting its tributaries and lakes. It has strategic ecosystems other than high Andean forest: paramo and high sub-páramo forest. These in turn harbor valuable vegetation cover: pajonal, flood zone, frailejonal, hills, springs and other geoforms, which add niches rich in biodiversity. In this way, scenarios are created for the majority of Bogotá's youth citizen training schools, for the promotion and management of sacred spaces in the district, through which school activities pass in large numbers, continuing in a tributary of high natural value, known as the Porciúncula River, which provides flow to the lagoon in the east of the city. Although they receive thousands of visitors every day, these hills are being transformed by exotic species, the reduction of their biodiversity due to development and construction projects in non-permissible areas and suburban encroachment.

The development of this new citizen science process, based on the management plan of areas and networks of arthropods, herps and avifauna outlined for the campus of the Universidad Politécnico Grancolombiano, is an initiative that faces important challenges, as it seeks to link different actors. These may be students, teachers, employees, graduates, inhabitants of the surrounding neighborhoods or the locality, from other parts of Bogota and, consequently, from all the heterogeneity of knowledge, interests, behaviors and attitudes that all of them have. It is possible that those who participate in some of the species collection and/or identification activities have a clear scientific orientation and participate due to their disciplinary interest, considering that the exercise they are carrying out is related to wildlife. In this case, the information that provides about the path taken by each species to arrive at a final catalog can be enriching and attractive for those who participate, allowing them to learn much more about the species and, possibly, to want to transfer some of these experiences to their laboratory work.

The interest is to awaken curiosity and learning, from the everyday and local in the University, to the global and international range of citizen science networks. At least, it is the desire of citizen science to build a governance of knowledge that provides sufficient autonomy to a democratic society as long as it is also more involved and knows more about the nature and forms of knowledge to be produced in order to redirect it towards social and ecological cohesion. Something active and common that is articulated with the social transformation of active knowledge. But for this, it requires authoritative signs and arguments within and outside democratic communities. They recognize that the sciences and their products cease to be exclusive belonging, although demanding in their instruments, to think it autonomously in each community and to the community of democratic communities.

CONCLUSIONS

With the citizen science processes and field days in search of herpetofauna, avifauna and arthropods in the eastern hills of Bogotá, students of the Politécnico Grancolombiano University campus were made aware of the environment, identifying herpetofauna, psittacines and avifauna through sightings, and reaching the conclusion that there is no single place within the eastern hills of Bogotá that is only in management areas, thus visualizing it in different areas adjacent to the campus. The Politécnico Grancolombiano community is immersed in a process of environmental awareness that allows the citizens of the campus to interact, know and enjoy the biotic richness of Colombia, entering into a dynamic of coexistence with its planetary systems and environment, assuming its impacts and proposing new forms of harmonic interaction; a way to contribute to the solution of the problems of increasing environmental deterioration of the planet and our City Region.

The main impact generated is to promote sustainable management spaces in areas of the process, to contemplate formal and informal education activities, with a scope to the entire educational community Politécnico, to integrate the external community to the university life, to allow the extension and social projection of the institution; to awaken the interest and taste for the biodiversity of Colombia. To establish firm steps in the promotion of research, to move towards an interdisciplinary and transdisciplinary training in the different specialties of the faculty, which continues to generate professionals who are not simple applicators of local or general knowledge in specific contexts, but generators of contextualized and regenerative knowledge, with conditions to analyze, understand and transform real concrete problems they face.

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