Abstract

Community-based surveys and monitoring are notable for the importance of results related to natural resource management and conservation, as well as representing desired and effective interactions between environmental managers, researchers and the lay public. Faced with this need, the term "Science-citizen", which describes partnerships between scientists and lay volunteers, has the potential to participate effectively in collecting and / or analyzing scientific data when applied to public interest topics. Based on this perspective, the “ConsCiência-Cidadã” program, a partnership between university, NGO and ICMBio, with the support of CNPq and FAPESP, was developed with the objective of contributing to the training of people, especially residents of the national parks (NP) to act as a citizen-scientist and to encourage volunteering. Three courses were carried out, from the point of view of science-citizens, which sought to stimulate, through various teaching strategies, scientific training, engagement in socio-environmental activities and improvement of the NP’s natural spaces.

Keywords: Environmental Education; Volunteering; Science-citizenship.

1 INTRODUCTION

For Irving [1], communities around conservation units (CU) have difficulty accessing education. This condition hinders the critical capacity of these populations and contributes to alienation in relation to the patrimonial value of the CU cultural and environmental base. On the other hand, this population is, in general, settlements that present a lower degree of degradation and human occupation and constitute social groups that can contribute with the governmental agents and of the civil society for the protection and management of the nature.

Community-based surveys and monitoring are notable for the importance of results related to natural resource management and conservation, as well as representing desired and effective interactions between environmental managers, researchers and the lay public. Faced with this need, the term "Science-Citizen", which describes partnerships between scientists and lay volunteers, has the potential to participate effectively in collecting and / or analyzing scientific data when applied to public interest topics.

For Silva [2], a citizen scientist is a person of the community who assists in scientific investigations through his actions and activities. In the case of birds, for example, the citizen scientist can contribute by monitoring and preserving the habitat of these animals. In addition, the author emphasizes that doing Science-Citizen is documenting new discoveries.

Cornell University is one of the main users and promoters of Science-Citizen, as researchers have used several volunteers in studies to monitor birds as well as in other research projects since the 1960s. However, they did not use the term "Science-Citizen" until the 1990s. Current Cornell Science-Citizen projects include studies of finch disease, urban bird research, and others [3].

Cornell scientists tracking Science-Citizen studies so far have found more than 200 research projects being conducted by researchers in North America. Some observers think there may actually be thousands. Working with scientific citizens is a phenomenon that grows in the world, but has not yet detailed in detail, says Dr. Esquiva, also a researcher at the University of Cornell [3].

According to data from the Brazilian Society for the Conservation of Birds [4], the participation of society in systematized bird counting is very popular in Europe and the United States. In this way, the number of observers that feed monitoring programs that are used to document consequences of anthropic actions to the environment grows.

There are many important reasons to observe birds. One of these reasons has already been proven, namely that bird watching and the contact with nature resulting from this practice make people happier, calm and focused. From this, it is important to train and improve the senses (hearing, vision,
sensations, among others) to be more attentive to the natural world. Thus, a bird observer acts in the conservation of nature, because they can identify those considered bioindicators - that are very demanding in relation to their habitat and sensitive to changes of the environment, as for example, the climatic changes [2].

These activities are based on the concept of Citizen-Science, which seeks to engage citizens in scientific debates and to broaden both active participation and society's commitment to building a public and engaged science. In Brazil, the Citizen-Scientist Project was created in 2014 by SAVE Brazil, aiming to promote the observation and monitoring of birds as a tool for the conservation of species and their habitats through the involvement of society following the concept of Science-Citizen [4].

Kaniak [5] already extolled the importance of volunteering for increased community involvement and public support for national park service. Volunteering also contributes to the expansion of existing programs and to implementing new projects that would not otherwise be initiated. Volunteer programs are based on the spirit of development and people's willingness to carry out actions and activities aimed at the preservation and conservation of national heritage, including ecotourism and the well-being of communities and visitors through the ecological training.

Ecotourism in Brazil stands out from the environmental movement, when debates about the need to conserve the environment through sustainable techniques reach the tourist activity. Over the years, the activity has been developing and gaining strength amid the discussion of a more responsible tourism model [6]. Voluntary programs related to physical, mental and socioenvironmental well-being are based on rural and / or agro-ecological work, understanding the importance of these as ancestral forms of human interaction with the environment, called eco-activities or ecological training [7], [8], [9].

The topics related to and prioritized in citizen-scientist training programs aim, in general, to involve people motivated to contribute to the common good, through the articulation of popular and scientific knowledge, promoting local impact and wide dissemination. We understand that it is a fundamentally educational process aimed at improving the current socio-environmental context through the criticism of the dominant economic and social forms of production, as well as proposing strategies to overcome the modus operandi, a central issue faced by Critical Environmental Education.

Environmental Education, in this perspective, can contribute to the formation of people as popular environmental educators by promoting the dialogue of knowledge between existing scientific knowledge and necessary for the conservation of natural environments to the cultural, cognitive and economic realities of the surrounding social contexts, such as proposes voluntary programs in the citizen-scientist model.

Based on this perspective, the “ConsCiência-Cidadã” program, a partnership between university, NGO and ICMBio, with the support of CNPq and FAPESP, was developed with the objective of contributing to the training of people, especially residents of the national parks (NP), to act as a citizen-scientist and to encourage volunteering. Three courses were carried out, from a Science-Citizen perspective, aiming to stimulate the scientific formation, the engagement in socioenvironmental activities and the improvement of the NP's natural spaces. In this article we intend to identify and analyze the teaching procedures present in the courses and their potential to contribute to the different aspects related to Science-Citizen.

2 METHODOLOGY

The NP chosen for the courses has the largest number of surveys, in addition to having an area of 20,024 protected hectares distributed in four municipalities of the State of Rio de Janeiro and being the third oldest park in the country, representing an important landmark in history of the Brazilian CU.

Each course has 40 hours of theoretical-practical activities taught by researchers-specialists in the respective areas and 40 hours of intervention activities in the NP and surrounding areas. The first course focused on scientific training provided tools for bird monitoring based on fixed point, path and scanning methods. The second course was based on the recovery of natural areas belonging to the NP and provided opportunities for studies and practices of ecological restoration of abandoned park trails, aiming at the restoration of native vegetation. The third course focused on the theoretical-methodological training for the construction of socio-educational projects necessary for the development of ecotourism in the NPs.
The three courses of the “ConsCiencia-Cidadã” Program were conducted between July / 2018 and April / 2019 and the theoretical-practical part happened at different times, but all in the visitor center and auditorium provided by the NP management.

The data were collected through the recording in field diaries of the observations of the classes, the plans of activities made available by the teachers and reports or projects made available by the participants. Data analysis was carried out in a qualitative way, seeking the triangulation of the results obtained in the various sources of information [10] in light of the theoretical perspective pointed out by Critical Environmental Education.

3 RESULTS

3.1 Profile of subjects

There were the participation of 88 subjects distributed in the three courses, being the majority of residents of the NP. In course 1, whose focus is on scientific training, 58% of the students were female. Most of the participants in this course (47%) were from the host city of the NP, 79% of participants had previously volunteered and 47% had completed higher education. In course 2, with emphasis on restorative practices, 50% of the participants were male and 50% female. The cities of origin of the students of this course 2 are the four understood by the NP. 46% of the participants had previously volunteered, 30% had completed higher education and 20% had completed graduate studies. In course 3, which focused on social and environmental engagement projects, 65% of the participants were female, 45% lived in the host city of NP, and 42% had previously volunteered. Regarding academic education, 23% had completed higher education, 19% had completed high school and 10% were post-graduates. It was observed throughout the courses, that the participants already presented a relation and interest on the environmental themes. Always proactive and willing to help with tasks, most of the time.

3.2 The teaching procedures in course 1: focus on scientific training

In the scientific training of the 22 subjects involved in the course it can be observed, in general, that they are already quite involved with questions of preservation of nature. It was common to question the purposes of the course concerning the actions and perspectives of Science-Citizen. They also reported on the importance of sensitization and the use of the senses for activities on trails. In addition, three students of the course were accredited drivers of the park, carrying out in practice and with different age groups various works on environmental awareness.

The classes presented were dialogues, that is, there was a good relationship between the teacher, students of the course, volunteers and professionals of the park, allowing greater interaction between them. In order to do so, some participants expressed their opinions on various subjects and discussed the following topics: environmental companies, wildlife observation, field care and behavior, efficient and respectful methods for animals, precautions for environmental damage, knowledge popular bird species, “Passarinhando” project.

In this way, the students' performance in the classes was based on the particular and general interests, questioning - what presents the group's interest - and concern with environmental issues. Practical field activities took place every day, with students in random groups with a monitor (person who knew the target species), forming a work team. This team chose one of the available tracks and applied one of the research methodologies. Sampling was most often performed by the group, moving silently on paths and points. At each section of the route and point, the people alternate to make the notes of the qualitative and quantitative records of the fauna. At fixed points, the group noted at least the target species they could safely identify, as well as their respective numbers of individuals in a conservative way (minimum numbers), within the 20 m density estimation radius, or outside the radius of 20 m, without distance limitation. Identification guides, one binocular per person and a specific field card for this method were used, which included tourist counts and their noise. The records were visual and / or auditory. In order for a person to go to the field to collect data, it was necessary to have a 90% accuracy in a previous test of the vocalizations of the minimum group of eleven species of birds. The tests were done through the Orientation Center, through the application in WhatsApp. Among the birds, a minimum group of focus species was selected through pre-inventory analysis, which conspicuity, ease of identification, medium or high abundance, and sensitivity to habitat and hunting changes.

The groups traveled on the course set by the teacher, walking slowly (1.5 to 2 km / h) and recorded all
individuals of species that could safely identify, at least the minimum group of target species. They were asked to write down the minimum trust - minimizing overestimates. The geomorphology of the region made it possible to record animals in excellent viewpoints of the canopy, emergent trees, valleys, slopes and air space. Two fixed points of scanning were established from two viewpoints used in complementary samplings of primates and predators, besides the registration of the target fauna of the sampling in fixed points and of what is more possible to identify and count on security. However, it is a method apart from fixed forest points, since the conditions of visibility and hearing are very dissimilar. Thus, the results generated by this method were analyzed separately from the others. The dwell time and fauna records at these points were twenty minutes, during which the groups scanned binoculars all the contours of valleys, cracks, slopes and ridges and peaks, with particular attention to emerging trees. Photographic cameras, telephoto lenses, tripods and or telescopes could be used. After the course, a database (Google Drive) containing literature, vocalization sound files, Power Point archives of the classes taught, data collection in the field, the General Volunteer Plan and its Field Tutorial (for be used in the field and resolve any doubts). These didactic procedures associated with observation techniques enabled the participants to appropriate the scientific methods of observation and characterization of the birds, encouraging the recognition of some local species and conservation characteristics of the species. That is, the data collected in the observation and recording of the materials produced by the students indicate the articulation of the knowledge brought by the subjects and the appropriation of new knowledge produced by science, adding fundamental elements for its performance in CU or other natural areas.

3.3 Methods of course 2: recovery and construction of areas and trails

In this course, three different teaching procedures were observed, including:

a) Direct observation of the natural environment and construction of knowledge through the collective elaboration of answers to key questions asked by the speaker, where for each question participants spontaneously present their answers and share their knowledge with the other participants, being that the minister corrected and complemented the answers as necessary. At the end of each answer, a word or key concept related to the topic discussed is written very clearly in a rectangle of colored cardboard hanging on a rope stretched between two trees at the edge of the forest. This procedure had the objective of interacting with the natural environment and leveling of basic knowledge, among which we highlight: tropical forest extracts, vital ecological cycles, nutrient cycling, biodiversity and resilience, plant groups.

b) Group work with presentation of the results in a playful way (ecoanimation). The group of participants was divided into four subgroups which had the task of discussing and listing the main agents of disturbance and degradation of a natural forest environment. Each subgroup chose one of the agents mentioned to be presented in a playful way (animated image known as “gif”) to the other groups. These in turn should find out which disturbing agent was being represented. This activity had the objective of leveling basic knowledge and fostering greater interaction among the participants. The contents referred to the agents of disturbance and degradation of a forest environment, such as: fire, wind, erosion, man himself, among others.

c) Lectures with the help of projections (concepts and photographs). This procedure also aims at leveling knowledge and visualizing experiences of ecological restoration processes through photographs. The themes focused on: history of the restoration of degraded areas in Brazil; ecological succession; ecological restoration methods and their implantation phases; restoration of the ecological processes of a forest; pact for the restoration of the Atlantic Forest; ecological restoration and climate change; economic sustainability combined with forest restoration; agroforestry systems; and agroecological principles.

These different teaching strategies promoted the articulation of theoretical and practical activities very intense during the course, providing direct contact of the participants in areas and trails of the NP, as well as the elaboration of a management plan to promote restoration through the use of nucleation technique. During the course totaled 40.51 m² of restoration of one of the tracks, representing 11.2% of the total area of the trail, which was 361.5 m². A new track was also built during the course, corresponding to 409.5 m² (273 m length X 1.5 m width) corresponding to the union of two existing tracks.

Another practical activity was the diagnosis for management, garbage collection and restoration of the “Meu Castelo” track, located in the NP near the city of Petrópolis / RJ. The objectives of this activity were: a) to take the participants to know a trail inside the park, but that is outside the nuclei of public
use, being thus little "cared" by ICMBio; b) provide a practical activity to diagnose and plan interventions, using the knowledge accumulated during the course and c) enable participants in the region to plan track management actions in this region of Petrópolis. In order to carry out this activity, foreseen in the planning of the course, it was necessary a "last minute" change in the initially planned logistics, since the bus to be donated by ICMBio to take the participants of the course to Petrópolis was without the safety belts, and its use was not authorized by the head of the NP. In a meeting with the participants, it was decided by a vote that the activity on said track would be maintained, and that for the displacement to Petrópolis, the participants' cars were used, with the fuel paid by the project (CNPq).

In this way, the activity was maintained and performed as expected, where in the field participants were divided into five groups, and each group was "responsible" for a 150-meter stretch of a trail, where they performed the diagnosis on the state of conservation and presented proposals to improve their maintenance, noting the diagnosis and the proposals in a field worksheet; as well as being responsible for the "garbage collection" present in that section. This diagnosis and its respective proposals were presented and discussed during the walk back to the NP observation site and the following day during the conclusion of the theoretical classes.

Also, in the initial part of this activity on the trail, there was interaction with the Mountain Bike group of Petrópolis that uses the aforementioned trail for their sports practice. From this interaction it was proposed to open a new stretch of trail exclusively for this sport, avoiding risks of accidents between cyclists and pedestrians, as bicycles descend the hill at high speed. An interesting and important observation made possible by this activity was the observation of many religious manifestations. The group suggested carrying out an Environmental Education work with the religious groups of the region and opening an exclusive trail for this purpose with the suggestion of the name 'Trail of All Saints'.

The course, in general, was theoretical-practical, with inviting activities, proposed in groups, which made the students work as a team. In addition, physical evaluations of course participants were performed so that this aspect could be measured in the research. Teachers have good communicability and initiatives for proposed practical activities in addition to making an important link from the theoretical part to the practical part.

3.4 Teaching strategies of course 3: realization of projects of socio-environmental engagement

In this course there are traditional teaching strategies alternated by differentiated teaching activities such as: lectures, dynamics, experiences, group work, project design and practical exercises of interaction with visitors.

The lectures and lectures were very present in this course, since in the proposed analysis it was intended the appropriation of certain fundamental concepts for the participation of the participants as educators in the communities that visit NP and those that reside in their surroundings. It is noteworthy that they are theoretical-practical exposition activities on community-based tourism - TBC in NP, public use management and environmental services, biodiversity as a tourist attraction. Also with use of this didactic resource we had the lecture on prevention of accidents and first aid given by the Fire Department of the NP region. The theme 'Ecology of real action' was presented to students with data on the relationship of man to nature, dynamic systems and affordances - AHA.

The dynamics covered different moments of the formative process, involving activities of group experience as one of the moments that the participants incorporated and represented the present and some extinct biotic and abiotic elements of the NP, such as animals, plants, geology, traditional and current communities its customs and culture, tourist attractions, preservation of biodiversity, the importance of the Atlantic Forest, historical aspects of the first escalations and culminating peaks, colonization, among others.

Practices on conscious behaviors in natural environments were also presented and simulated in this course. The students were divided into groups and had a period of time to plan a presentation of the theme chosen by the students in the form of mime and the other students needed to guess the theme of the group. A practical activity on solid waste management was also carried out by the teacher, in which the students divided into groups and interviewed the park's employees on the waste issues generated in the park, their destination, places with the greatest waste problems, among others.

A research activity carried out was the exploratory diagnosis that the students of the course carried out with the parkgoers at a given moment. With questions developed by the teachers of the course,
with the prospect of tracing a profile of park visitors (age, profession, sex, whether they live in the city or outside), how many days they spend in the city, how much they spend and what they spend in the park, suggestions for the park, among others. The data obtained by the students were systematized and commented on by the teachers, followed by a practice adapted from the "Workshop of the future" methodology, where each presented his dream to the world, for himself and for the project in the park.

The next step consisted in the formation of five groups to agree on an idealized collective project and to detail the plan of action for its execution, taking into account the obstacles. In addition, a presentation was made on the theme "Environmental Education and Citizen Science", which aimed to sew the themes worked in the previous days of the course. Topics such as Education, Environmental Education, Science-Citizenship, presentation of the “ConsCiencia-Cidadã” program, presentation of the Clube da Mata and diagnosis of expenditures in Brazilian universities. At that moment, guidelines and a model of intervention plan were passed for the groups to begin to think about the 40 hours of practical intervention, taking up the projects devised in the Workshop of the Future.

In this way the students were divided into groups to prepare the proposal of the intervention plan, which they held in the park in 40h. The proposal was for the students to discuss in a project to develop in the intervention stage of the course.

The Intervention Projects were as follows:

a) "Barrier Project": which sought to integrate the UC, the visitors, the community, the local parish and qualified drivers, strengthening the participative management in the neighborhood Barreira - Sede Guapimirim. Survey of information about the region. Field visit made by walking through the neighborhood in which the methods of direct and participant observation were used, photographic record and interviews in the semistructured format with local residents and entrepreneurs. For the production of geographic data, the remote sensing method was used through the Google Earth software. The objective of the group was to obtain a diagnosis of the situation and the opinion of those involved. Mainly, we initiate a dialogue, the promotion of participative management, the preservation of cultural and natural historical patrimony, the incentive to volunteer and support the recovery of the property for the creation of the Bernardelli Cultural Center. The result should be the creation of a socio-environmental transformation in the locality with strengthening of low-impact tourism, belonging to the region, historical recovery, environmental awareness, public use and income generation in the area.

b) "Nature in LIBRAS": It aimed to enable quality in the visitation of the Surda Community, providing better communication between them and NP employees, for this a field survey was carried out with the surveillance sector, the reception center visitors to the park, ticket office and parking for data collection on the interest in participating in the workshop LIBRAS (Brazilian Sign Language). After this stage a workshop was prepared according to the demand of the employees. A survey was also carried out with some visitors who entered the park on LIBRAS. Research has shown the importance of having a LIBRAS interpreter for the reception of deaf people and the need for basic knowledge of the language by park staff.

c) "Knowledge to act": Diagnosis of the reality and environmental perception of students from two schools around Morro Meu Castelo (District: Morin, Petrópolis-RJ) -. The objective of the project was to make a survey about the necessary conditions for a environmental education activity with students of the region in relation to the locality of Castelinho. Visit the schools and check if there is interest in the project and its application and what are the best ways to reach the goal. It was sought to verify if the school already has projects of the students or teachers that can be used in the elaboration and execution of the project. Application of activities to get acquainted with students’ perceptions about nature, National Park (UC's), the environment where they live and what is around them and the community. Discuss the results of the interviews with the group and carry out a rapid participatory diagnosis. Elaborate a future plan / project of action with these students that integrate them to the nature and the region of the Castelinho.

d) "Elaboration of a script guide for the NP trails": The overall objective of the project is to bring visitors to the park a differentiated view of trails. Bringing information to them from different areas, subtly working on environmental awareness, leading them to understand the environment and to recognize themselves as something that is part of this natural environment. Recognize yourself as nature and be able to pass on the information learned ahead. A diagnosis was made to understand the demands of these visitors, if the guide would be interesting for them and also three employees of the park were interviewed. The questions were elaborated to understand a little more about the cultural historical factor of the tracks in question.
and to make something closer to the reality of the visitors. It was noticed that the majority of NP visitors do not have direct contact with Environmental Education, or the activities can not reach visitors massively, but in parts (of those who had some contact, a large part were in the school in which they studied), with sensitizing activities.

e) "The rescue of the history of the NP": The objective of the project was to seek the interaction of public schools and visitors, in general, about the history of the CU. Thus, he sought to integrate the people from the surroundings, from videos and lectures that tell the history of the park.

f) "Replantation of native seedlings with edocumunication": The objective of the project was to plan educational activities with independent audiovisual production, seeking the integration and inclusion of the community in the park, produce audiovisual material and reproduce it in schools in the region.

g) "Knowing to preserve": The general objective of the project is to pass on the knowledge obtained in the course of community-based ecotourism in public and private schools, through the selection of information for the development of courses and workshops; application of the knowledge to the target public; creation of multipliers of the knowledge acquired in the course and open courses of drawing and photographs. All the projects presented were based on reflections and techniques proposed by the teachers throughout the course. Since the beginning of the course, students have already been encouraged and included to participate in the joint creation of the practical intervention project, which is part of the 40 hours that are part of the course proposal.

4 CONCLUSIONS

In the present research, we sought to identify and analyze the teaching procedures present in the courses and their potential to contribute to the different aspects related to Science-Citizen. Thus, among those selected for the course, it is important to indicate that they are, for the most part, residents of the NP environment, which contributes to the positive interrelation between the two. In addition, regarding the scientific training of the subjects, most of them were "sensitized" and had knowledge about the environmental issue, that is, the relationship with the environment was already familiar.

In the three courses, theoretical and practical classes were held in which positive relationships were observed between teachers, students, volunteers and NP monitors.

In course 1, birds were monitored, allowing the participants to acquire important concepts for their accomplishment, such as feather characteristics, singing, habits and habitats of these animals. In addition to this, students learned three methodologies in order to perform the monitoring: fixed points, path and scan. The data presented by the students were compared with those of the previous inventory carried out by the professor and researcher of the area. The course was based on the methodology of Science-Citizen.

In the activity of recovery and construction of trails - course 2 - the main methods used were the observation and integration of the subjects, besides practical action which opened a considerable path needed in the park and also the restoration and creation of seedlings beds, which in the future, may possibly be observed by the developing subjects and becoming part of the local vegetation. In this activity students were able to learn concepts of vegetation, such as what are pioneer, primary, secondary and climax plants, as well as to build an adequate trail and reforest spaces that need this, in addition to the relationships made by teachers of their actions with the behavior and management plan of a CU. Some subjects continued these actions, even after the end of the course, with the NP volunteering group on Wednesdays, with the park volunteer instructor and monitor.

As for course 3, the activities carried out during the theoretical-practical classes gave subsidies and guidelines for students to construct the intervention project of interest to the respective groups. The intervention projects put into practice and resulted in learning about environmental issues by the subjects and also about the political, economic and social relations that exist between the CU and the surrounding populations, these being often limiting to environmental actions in these places. The relationship of the participants with the PA and the populations surrounding the NPs, besides themes proposed in the three courses, such as bird monitoring, ecological training and community-based ecotourism, allowed the subjects to approach different environmental themes. The presence of various teaching procedures and techniques, in addition to relevant discussions, data surveys contributed to the scientific training of the subjects, improvements to the NP and incentive to volunteer work.
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