

Solid waste disposed in the surrounding of Caetés Ecological Station - PE: opportunity of environmental education

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ABSTRACT

Several human activities have affected the integrity and balance of conservation unit, compromising the efficiency of the preservation of biodiversity, natural resources and cultural. This work aims to study the solid waste irregular disposition in the surrounding of Caetés Ecological Station (PE) and the impacts on site, as well as presenting a proposal of environmental education program involving the local community. The problem has been identified through visiting areas, resulting in primary data, which were crossed with secondary data about solid waste and its negative effects, as well as on environmental education in communities. The environmental education program developed consists in lectures, dynamics, workshops, partnerships with local schools and training. The community mobilization expected in the program will rescue of the history of the Caetés Ecological Station.

Keywords: Conservation unit, Environmental impacts, Environmental education.

Introduction

In Brazil, one of the most common sources of environmental pollution is the solid waste disposed irregularly by its generator or by intermediaries. According to the Brazilian Association of Public Cleaning and Special Waste Companies - ABRELPE (2013), in Brazil, in 2013, the total generation of municipal solid waste was 76,387,200 tons, representing a growth of 4.1% in relation to the last year, being greater than the population growth rate (3.7%). In that period, despite having identified an improvement in the collection rate of waste generated (4.4%), there were more than 20,000 tons of urban solid waste not collected daily in Brazil.

The solid wastes not collected are inadequately disposed in the environment and can contaminate the environmental compartments, such as soil, water body and atmosphere, affecting living beings, including man (SOARES et al., 2007). In the conservationist perspective, it becomes worrying when contamination occurs in the vicinity of

protected areas where biodiversity must be protected.

Brief history of protected areas

The first concepts of protected areas in Brazilian legislation appeared in 1934 in the Brazilian Forest Code, which was later modified by adopting new criteria for the determination of protected areas and exploration areas. In 1967, the Brazilian Institute of Forestry Development (IBDF) was established by Decree No. 289, having as one of the objectives the management of conservation units, which were previously the responsibility of the Ministry of Agriculture.

Subsequently, in 1973, another agency was created to assist in this process of management and implantation of conservation units, the Special Secretariat for the Environment (SEMA), a federal agency that, although acting in a disconnected way with the IBDF, established two new categories Of conservation unit to the national system: ecological stations and areas of environmental

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protection, besides participating in the articulation of the elaboration of Law 6.938 / 1981, which instituted the National Environmental Policy.

In 1979, the IBDF also worked on the development of the first stage of the Conservation Units System Plan in Brazil, based on the categories of protected area management presented by the International Union for Conservation of Nature (IUCN). In the second stage of the plan of the system of conservation units some changes were favored in favor of the direct use of the natural resources, thus counteracting the preservation of the same ones (BATARCE, 2010; HOSAKA, 2010; INSTITUTO BRASILEIRO DO MEIO AMBIENTE E DOS RECURSOS NATURAIS RENOVÁVEIS, s.d.).

Nevertheless, the plan was not legally recognized, because the system of conservation unit was confused in its objectives and definitions of categories at the municipal, state and federal levels (RANDLANDS, BRANDON, 2005). Since then, government institutions and a nongovernmental organization have studied and debated the issue, until in 1992, Bill No. 2.892 / 1992, which proposed the National System of Conservation Units (SNUC), was submitted to National Congress, until it was approved in 2000, through Law 9.985 (RANDLANDS, BRANDON, 2005, HOSAKA, 2010).

With the emergence of the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA), resulting from the unification of IBDF and SEMA, in 1989, the functions of management were centralized in one agency, avoiding disorganization of assignments, which was recurrent among two institutions (RYLANDS, BRANDON, 2005). Since 2007, national conservation units are managed by the Chico Mendes Institute for Biodiversity Conservation - ICMBio, an autarchy linked to the Ministry of the Environment.

According to the Ministry of the Environment (BRASIL, 2008, page 4), conservation units are "areas established by the public authority for the protection of fauna, flora, microorganisms, bodies of water, soil, climate, landscapes, and all ecological processes relevant to natural ecosystems". According to the study, protection covers the "historical-cultural heritage and the practices and way of life of traditional populations". Law 9,985 / 2000 classifies conservation units into two groups: integral protection units and sustainable use units, which differ in the management granted by the specific regulation and the management plan of the same.

Ecological Station (ESEC) - Conservation unit of integral protection

One of the categories of units of integral protection is the Ecological Station, which according to the SNUC law, is an area for the preservation of nature as well as for scientific research, the latter being subject to prior permission of the competent body. The mentioned law

maintained the same objective traced in 1981, when Law 6.902 established on the creation of Ecological Stations and Areas of Environmental Protection. There are some regulated cases of interference in protected ecosystems of ESEC, which contribute to the realization of the unit's functions. The exceptions are: restorative actions in altered ecosystems; Management of species to preserve biodiversity; Scientific research, both in simple collection of elements that are part of the protected ecosystem like those that cause impacts to a greater extent having a limit of 3% of the total unit or a maximum of 1,500 ha (BRAZIL, 2000).

Complementing the regulations regarding the Ecological Station, Decree No. 99.274/1990, which regulates Law No. 6.902/1981 and also the National Environmental Policy, establishes in its art. 27 the subordination of activities carried out within a radius of 10 kilometer, which may reach the existing biota in a conservation unit, to Conama's standards. This mechanism, in turn, is regulated by Conama Resolution 13/1990, which deals with the norms related to harmful activities carried out around the units and must be licensed by the competent environmental agency. In the meantime, this Resolution was revoked in 2010 by Conama Resolution 428, which details the dependence of licensing on the authorization of the agency responsible for managing the unit (GANEM, 2015).

Decree No. 99.274 / 1990 still lists a series of infractions that are susceptible to fines, among which, this work highlights item III of art. 34: "to emit or discharge solid, liquid or gaseous effluents or wastes that cause environmental degradation, contrary to that established in special resolution or license", since it has been one of the problems identified at Caetés Ecological Station, where it was carried out the study.

Environmental Education

Recently, the National Policy of Solid Waste - PNRS was established by Law No. 12.305 / 2010, which brought obligations and targets for public managers to commit themselves to reversing the current situation of solid waste. One of the instruments of the PNRS, being one of the most discussed subjects since the seventies, is the central theme of Law 9995/1999, which defines environmental education as processes that through the individuals develop social values, knowledge and competences related to environmental conservation, well of common use of the people, relevant to the sustainability and quality of life.

In this construction process, is inevitable a reflect on environmental complexity and the appropriation of nature, implying in changes of favorable attitude to socio-environmental sustainability (JACOBI, 2003).

The sensitization of the source of solid waste is a substantial step in the waste management process,

because is a cultural-behavioral problem (PENELUC; SILVA, 2008). This modality of environmental education, non-formal environmental education, consists in environmental educational actions and practices that mobilize the collectivity for environmental conservation (BRASIL, 1999).

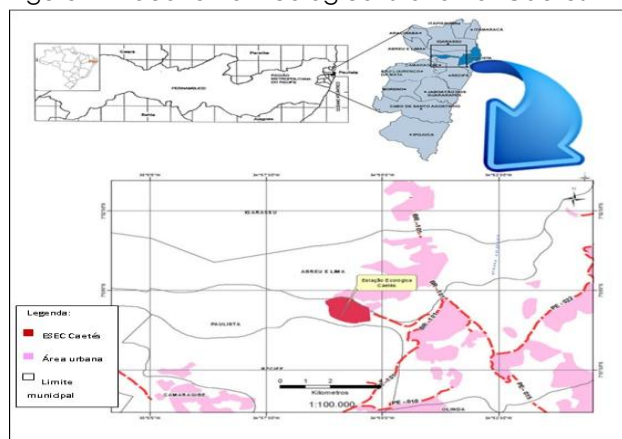
Material and Methods

Study Area

The study was carried out at the Ecological Station of Caetés - ESEC Caetés, located in the city of Paulista, located in the Metropolitan Region of Recife (RMR), in the state of Pernambuco between coordinates 7°55'15" and 7°56'30" South Latitude and 34°55'15" and 34°56'30" West longitude (Figure 1). The unit is delimited by the following geographical limits: Paratibe River and the border with the municipality of Recife, to the south; Arthur Lundgren Industrial District (Paulista) and former Amorim Primo S.A. factory, to the east; Fazenda Seringal Velho and rural area of Paulista and Abreu e Lima to the west; And housing complexes Caetés I and II (Abreu and Lima) and PE-18, to the north (AGÊNCIA ESTADUAL DE MEIO AMBIENTE E RECURSOS HÍDRICOS, 2012).

Being an area of forest remnant of the Atlantic Forest of the state, occupying an extension of 157.1 ha, was initially established as an Ecological Reserve by Law 9.989/1987 and later redefined as Ecological Station through Law 11.622/1998, for reasons of adequacy to the proposals of bill of the National System of Conservation Units (SNUC) and to the interests of the surrounding community and of public and private entities of use of the area (AGÊNCIA ESTADUAL DE MEIO AMBIENTE E RECURSOS HÍDRICOS, 2006). In addition to the conservation objectives, ESEC Caetés has a fundamental role in raising awareness of the RMR population in the ecological issue, which enables the local population to participate in the process of unit management, a condition established by the Law that instituted SNUC (BRASIL, 2000).

Figure 1 - Location of Ecological Station of Caetés – PE



Source: Agência Estadual De Meio Ambiente E Recursos Hídricos, 2012

The municipality of Paulista has a warm humid tropical climate (As' in the climatic classification of Köppen), with heavy rains season between March and August, with an annual average rainfall of 2,000 mm. Its vegetation is classified as Dense Ombrophylous Forest, constituted by 192 species, identified until the present moment, being 37 species endemic of Brazil and 20 exclusively of the Atlantic Forest. Two tree species that are threatened with extinction can still be found on the ESEC flora (AGÊNCIA ESTADUAL DE MEIO AMBIENTE E RECURSOS HÍDRICOS, 2012).

In the Management Plan of ESEC Caetés - Socioeconomic and Environmental Diagnosis (2012), a significant fauna diversity has been registered, mainly the avifauna, with 166 species, of which 15 species endemic to the Atlantic Forest can be highlighted, and 10 are threatened with extinction, therefore representing an important refuge for the native avifauna. Other classes contribute in the composition of the fauna of the unit as some species of the mastofauna, emphasizing the chiroptera, with 15 species identified; about 20 species of anuran amphibians; 13 species of snakes and 7 species of lizards; and 38 species of insects (AGÊNCIA ESTADUAL DE MEIO AMBIENTE E RECURSOS HÍDRICOS, 2006).

Among many factors that undermine the integrity of the unit studied, the disorderly growth of the surrounding population, mainly in the form of irregular occupations, has become a chronic problem for the ESEC as well as for the whole region due to the negative effects that are generated, such as increased solid waste generation and inadequate disposal, improper sanitary sewers and illegal exploitation of natural resources (AGÊNCIA ESTADUAL DE MEIO AMBIENTE E RECURSOS HÍDRICOS, 2006).

Data Collection

The present qualitative and purposeful study initially identified the problem of solid waste through visits to the site between the years 2013 and 2014. In addition to the observations, the data collected in the field consisted of reports from the employees of ESEC Caetés and photographic records, which were crossed with secondary data in the literature related to solid waste and its negative effects, as well as environmental education in communities. Together they subsidized the analysis of the current scenario, as well as the proposal of the environmental education program in the surrounding community. As a premise of this program, one of the premises described by Loureiro (2006, p. 40) was adopted in a study on the criticism of two recurring categories in environmental education, which describes the following: "the definition of education as praxis and dialogical process, critical, problematizing and transformative of the objective and subjective conditions that constitute reality".

Results and Discussion

At all visits, no exception, solid residues were found disposed within the boundaries of the unit, including the internal area in small amounts. Oliva Júnior and Freire (2013) points out that there is an increasingly exaggerated increase in municipal solid waste. These are collected and disposed of improperly in inappropriate areas, causing with this, a series of damages to the health of the population and the environment. Still for these authors, the major aggravating factor is that nature is not prepared to decompose so many residues with different physico-chemical compositions, thus, environmental degradation and consequent loss in the quality of life of society. This problem with solid waste has been observed frequently in other conservation units in Brazil, such as in the Municipal Parks of Uberlândia: Municipal Natural Park Victory Siqueirolli and Municipal Natural Park of Oil, the latter classified as a conservation unit of integral protection (MOREIRA et al., 2011); and in the State Park of the Fontes do Ipiranga in São Paulo (CERATI et al., 2011).

The solid residues found around the Caetés Ecological Station were of the domestic type, being observed from packaging, food waste, furniture to decomposing animals, as well as construction waste (Figures 2A and 2B). It is known that the main source of inadequate disposition of waste is the residents of the region, although there is a collection 3 times a week, carried out by the Abreu and Lima City Hall. Problems involving issues of bad disposal of solid wastes have been frequently observed in other conservation units in Brazil, such as in the State Park of Poeta and Repentia Juvenal de Oliveira, located in the city of Campina Grande, Paraíba (SOUZA et al., 2014) and in the State Forest and Ecological Station of Assis, municipality of Assis, São Paulo (LEITE; BONGIOVANNI, 2014). For Lira et al. (2017), mismanagement and inadequate disposal of waste generate increasingly significant social and environmental impacts on the environment.

Figure 2 - Solid waste disposed around ESEC.



Source: Nishiwaki, 2017

Marques et al. (2012) and Nishiwaki et al. (2016) claim that inadequate disposal of solid waste has endangered public health and modified

environmental quality, contaminating the edaphic, atmospheric and water environment, which at high levels compromise the lives of the human population, fauna and flora local. Corroborating this idea, Gouveia (2012) points out that the inadequate disposal of solid waste in the soil, as in dumps, causes exposure to various toxic substances.

Another negative effect related to human health is the attraction and proliferation of vectors that transmit diseases (PINHEIRO et al, 2016), such as rats, dogs, cats and urban pests such as cockroaches and scorpions. Deus et al. (2004) confirm this relation of the cases of diseases with the solid residues by indirect route: trash-vector-human. Figure 2 demonstrates this risk in the community in which it shows a domestic animal feeding on solid waste in which a corpse of an animal was present. According to Alho (2012, p.158), vector-borne diseases are associated with occupation and land use, usually involving "deforestation processes and precarious human settlements, with accumulation of waste and contamination of water bodies". Still according to the author, such diseases also threaten the conservation of biodiversity. Therefore, not only the health of the surrounding community is at risk, but also the wild animals of the conservation unit, that just as the vectors are attracted to the solid waste, the animals of the unit are also able to ingest and injure themselves through of waste.

The Chico Mendes Institute for Biodiversity Conservation - ICMBio (2014) found this negative impact on wild fauna caused by waste left by visitors to conservation units. Awareness-raising actions are carried out in the federal units of integral protection in several Brazilian municipalities, such as in the National Park of Brasília, where cleaning and promotion of environmental education through banners and plaques were carried out, as well as in the Tijuca Park in Rio de Janeiro, which in addition to educational actions, were made cleaning and trash facilities with anti-wildlife locks.

Solid waste in attracting animals can also cause susceptibility to hunting, an illegal practice very common in the vicinity. Considered as an environmental crime, in cases of absence of authorization from the competent body, foreseen in art. 29 of Law 9605/1998, hunting is one of the main causes that threaten biodiversity worldwide (GANEM; DRUMMOND, 2011). In order to have an idea, the populations of the species Guaribas-red-haired (*Alouatta belzebul*) and Yellow-bellied Monkey (*Cebus xanthosternos*), primate of the Atlantic Forest, reduced respectively by at least 30% in the last 40 years, and in more than 80% in the last 50 years due to hunting and habitat loss (INSTITUTO CHICO MENDES DE CONSERVAÇÃO DA BIODIVERSIDADE, 2011).

From the analysis of the waste situation faced by the conservation unit managers, it was possible to design an environmental education program targeting the local community. The program

consists of six stages, which aim to raise awareness and contextualize the community in the question of their role in the disposal of waste and its responsibilities as a member of nature. The steps are set forth in Frame 1.

Frame 1 - Stages of the proposed environmental education program for the local community.

Stages of the environmental education program
Lectures related to the protection areas and the problems faced, such as the history and the role of Caetés ESEC; the impacts caused by solid waste on the environment, fauna and public health; the importance of conservation of flora and fauna as well as natural resources, among others
Guidance on the practice of 3R's (Reduce, Reuse and Recycle), demonstrating diverse situations for its applicability in daily life
Dynamics and thematic workshops, using recyclable solid waste, clarifying about recyclable materials
Workshops on composting techniques with organic waste
Partnerships with educational institutions close to the community, encouraging formal environmental education
Technical updating of waste pickers resident in the local community

In the composting workshop will be instructed on the biological process of decomposition of organic waste and its transformation into organic compost, thereby encouraging ecologically correct practices. A successful example of applicability of this technique in the educational process is the composting unit of the Bonsucesso Environmental Education Center, idealized by Olinda City Hall. At this site 60% of the solid residues that came to the Center were composted, obtaining a systematic production of organic compounds for landscaping purposes (SOARES; SALGUEIRO; GAZINEU, 2007). Also in this study, it was revealed that a quarter of those wastes were recycled, thus also demonstrating the viability of recycling activity in environmental education. The same success has been observed in school communities, used as a tool for the diffusion of environmental education (SANTOS; FEHR, 2007; OLIVEIRA et al., 2012).

The participation of educational institutions is fundamental not only as agents transmitting knowledge, but also as, according to Elali (2003), diffusers of social norms, which by means of the repetition and modification of attitudes and behaviors in everyday life, can consolidate as socially accepted practice. According to Ferreira et al. (2013) it is noticed that in the school context, it is necessary to develop actions with the objective of educating for the preservation of the environment, where there are educational actions and practices in defense of the environment.

As for the technical updating of the waste pickers, it is intended to address issues such as management, health, safety at work and the environment. The involvement of the waste

pickers in the program will both ensure proper disposal of community waste and value the work of these agents, rescuing their self-valorization, being one of the benefits identified in Baeder's work (2009). Similar results were observed in the study by Nascimento et al. (2006) with "Amigos do Lixo" cooperators, called "environmental agents", who besides being trained in the collection of recyclable materials, participated in socio-environmental events and were responsible for the community environmental education program.

The program intends to work together with the selective collection system in Caetés ESEC, which recently were integrated waste pickers belonging to the cooperatives of the municipality of Abreu and Lima located in the district of Fosfato, having the work optimized by bicycles collectors - "ecobicycles". In order to support the activities, it will seek assistance from the municipal public authorities, which has the obligation to implement the selective collection in the municipalities, a commitment originated by the PNRS.

Environmental education is already part of the activities of the Caetés unit, in which the present work will specifically add knowledge and new sustainable habits to the community. This study corresponds to the Subprogram of Environmental Education and Interpretation that composes the management programs foreseen in the management plan of the Caetés ESEC, whose objective is to promote "understanding of the environment, favoring actions aimed at raising awareness of the environmental cause" (AGÊNCIA ESTADUAL DE MEIO AMBIENTE E RECURSOS HÍDRICOS, 2006, p. 34).

Conclusions

In contradiction to the struggle for the creation of the Caetés ESEC faced by the environmentalists and residents of Caetés I, who with commitment managed to embargo a landfill project outlined for the place, today the community despises this historic achievement by leaving the waste on the edges of the unit.

The struggle for ESEC in the past is reborn with the proposal of this work, which intends to mobilize the community again, with the participation of the new generation. The key to solving this problematic is in maintaining the legacy that environmental education will leave, for this it is necessary the commitment of all, both of the public authority, supporting in the educational actions and its dissemination, as well as the local community, exercising its role of citizen responsible for the natural patrimony, guaranteeing, therefore, the collective welfare, and the conservation of the nature.

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