# NATIONAL ENVIRONMENTAL EDUCATION POLICY AND IMPACTS OF WIND FARMS: A BIBLIOGRAPHIC ANALYSIS IN POTIGUAR MUNICIPALITIES

## *POLÍTICA NACIONAL DE EDUCAÇÃO AMBIENTAL E IMPACTOS DOS PARQUES EÓLICOS: UMA ANÁLISE BIBLIOGRÁFICA NOS MUNICÍPIOS POTIGUARES*

## *POLÍTICA NACIONAL DE EDUCACIÓN AMBIENTAL E IMPACTOS DE PARQUES EÓLICOS: UN ANÁLISIS BIBLIOGRAFICO EN MUNICIPIOS DE POTIGUARES*


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**ABSTRACT**: This work aims to analyze the performance of environmental education promoted by wind farms in Rio Grande do Norte´s municipalities, starting from the perspective of the impacts on the natural, socioeconomic, and cultural environment. For that, a systematic review of dissertations and theses that dealt with this topic was carried out using the case study or comparative analysis technique. In the results, it was verified uniformity of the authors that, in general, the wind farms do not effectively maintain programs of environmental education, mainly, after the installation of the parks, as determined by the legal system for environmental licensing, with the accomplishment of significant negative impacts on the social, economic and cultural contexts of traditional populations.

**KEYWORDS**: Non-formal education. Principle of totality. Wind farms.

***RESUMO***: *Este trabalho tem por objetivo analisar a atuação em educação ambiental promovida pelos parques eólicos nos municípios potiguares sob a perspectiva do princípio da totalidade e da educação não formal. Para tanto, foi realizado uma revisão sistemática de trabalhos de dissertações e teses que trataram sobre este tema e usaram a técnica de estudo de caso ou de análise comparativa. Nos resultados, constatou-se uma uniformidade dos autores de que, em regra, os empreendimentos eólicos não mantêm, de forma efetiva, programas de educação ambiental, principalmente, após a instalação dos parques, como determina o ordenamento jurídico para o licenciamento ambiental, com a concretização de impactos negativos significativos nos contextos social, econômico e cultural das populações tradicionais.*

***PALAVRAS-CHAVE***: *Educação informal. Princípio da totalidade. Usinas eólicas.*

***RESUMEN***: *Este trabajo tiene como objetivo analizar el desempeño en educación ambiental que prues eólicos en los municipios del Rio Grande do Norte con la perspectiva del principio de totalidad y la educación no formal. Para eso, se llevó a cabo una revisión sistemática de disertaciones y tesis que trataron sobre este tema y que utilizaron la técnica del estudio de caso o análisis comparativo. En los resultados, hubo una uniformidad de los autores que, por regla general, los parques eólicos no mantienen efectivamente programas de educación ambiental, especialmente después de la instalación de los parques, como determina el régimen legal de licenciamiento ambiental, teniendo, con la implementación, importantes impactos negativos en los contextos sociales, económicos y culturales de las poblaciones tradicionales.*

***PALABRAS CLAVE***: *Educación informal. Principio de totalidad. Plantas de energía eólica.*

## Introduction

Since the 1990s, warnings in Brazil about the need to diversify the energy matrix have intensified (Brasil, 1999). In this context, addressing environmental issues requires a multidimensional approach that includes economic and social perspectives, highlighting the fundamental importance of environmental education in the process.

In this theme, in Brazil, in 1999, Federal Law No. 9795/99 was published, which established the national policy of environmental education. This law selected as one of the basic principles of environmental education "the conception of the environment in its entirety, considering the interdependence between the natural, socioeconomic, and cultural environments, under the focus of sustainability" (Brasil, 1999, art. 4, II, our translation), which represents the principle of totality in environmental education.

According to this norm, environmental education should not only be conceived in terms of formal teaching but also informal, which involves "actions and educational practices aimed at raising community awareness about environmental issues and their organization and participation in defense of environmental quality" (Brasil, 1999, art. 13, our translation). Thus, the intention of the law is the formation of the ecological subject, understood by the incorporation of an organizational ecological orientation (Carvalho, 2013).

It is emphasized that environmental education should maintain a transversal and total vision in terms of interaction between the State, Market, and Society by contributing to citizenship and understanding of public problems relevant to human development. Thus, environmental education can generate reflections and point to social and political subjects in a concrete way that materializes social responsibility for oneself, practical actions, and the consequences of actions, considering the dimension of collective life (Angelis; Baptista 2020).

One of the central themes related to environmental education is the concern with global warming, which has generated significant debates and investments in clean energy sources. Thus, in the 1990s, wind energy began to be seen as an essential alternative deserving of public policy support, with wind farms defined as "installations and equipment intended for transforming the kinetic potential of winds into electrical energy" (Brasil, 2015, our translation). In the 2000s, the process of installing and expanding wind power projects began, notably in the Northeast region, with Rio Grande do Norte currently being the largest producer of wind energy in the country (Rio Grande do Norte, 2022).

From this situation, one May ask: how can we understand the implementation of the principle of totality in environmental education in light of the actions of non-formal education

and the respective impacts on the natural, socioeconomic, and cultural environments generated by the installations of wind farms in the municipalities of Rio Grande do Norte?

Thus, the general objective of this work was to analyze the performance of non-formal environmental education promoted by wind farms in the municipalities of Rio Grande do Norte from the perspective of the impacts on the natural, socioeconomic, and cultural environments. To achieve this general objective, a systematic review of literature in dissertations and theses located in Rio Grande do Norte was conducted, which made use of case study techniques or comparative analysis, as will be detailed in the methodological section.

The specific objectives were: to verify the environmental education initiatives of the wind power enterprises in terms of promoting educational campaigns, ecotourism, and participation of society, traditional populations, and farmers for the protection of environmental conservation units and sustainable management of resources; and to verify impacts related to the natural, social, economic, and cultural environments of the wind power enterprises directly linked to these initiatives.

This topic is recent and is justified due to its relevance and scant exploration. In research carried out on the Scielo platform, searching for the terms “principles” and “environmental education” across all indexes, only eight works were found from the period of 2018 to 2013, and of these, only one (Ordonez-Diaz; Montes-Arias; Garzon-Cortes, 2018) focused on non-formal education. In a new round, the search was repeated, this time without temporal limitation and adding the term “Wind”, which yielded no results.

In terms of structure, following this introduction, the theoretical framework will be presented with conceptual delimitation regarding the National Policy of Environmental Education and the principle of totality in environmental education, contextualized to the wind sector. Subsequently, the materials and methods used in this research will be clarified, and the data presented and the results analyzed. Finally, the conclusions will be highlighted.

## The National Policy on Environmental Education and the Principle of Totality

Since the 1980s, international debates on the conceptual and practical importance of integrating sustainability into development have become more prominent. This development involved, from the UN's Right to Development treaty (1986), five intrinsically linked dimensions: political, cultural, social, economic, and environmental. These spheres point towards a direction for governmental actions aimed at improving the quality of life for the

population, in order to enable broad freedom linked to the concept of human dignity (Sen, 2010) and to meet the Millennium Development Goals (ONU, 2015a) and the respective 2030 Agenda for Sustainable Development (ONU, 2015b). Environmental Education, therefore, was established as a critical element for promoting a new development model based on the quality of life of society (Dias, 2010).

In this context, environmental education is presented as an essential tool for achieving development. It stems from the principle of participation, making the individual feel active and responsible for the necessary changes for environmental preservation. However, it is cautioned against generalizing the emancipatory perspective to any educational practice, such as mere content delivery (Farias; Farias, 2020; Machado; Garcia; Amim, 2006; Viera; Zanon, 2023).

Thus, Environmental Education is emancipatory when it stimulates the freedom and autonomy of individuals. At the same time, it must also be critical to highlight the social, historical, economic, and political context in which social relationships in nature are founded, with the purpose and commitment to overcome the production model. In this way, Environmental Education can be seen as informative and cultural, but mainly political and emancipatory, and therefore transformative of existing social relationships (Dolci; Molon, 2018; Viera; Zanon, 2023).

However, from a critical standpoint, Santos (2000) explains that the project of modernity presents two forms of knowledge: regulatory knowledge and emancipatory knowledge. In the former, the state's action through public policies would be to move from chaos (ignorance) to order (knowledge), following a positivist orientation of subject formation. The perspective of the latter is to take society from colonialism (ignorance) to solidarity (knowledge). According to the author, there has been a predominance of regulatory knowledge over emancipatory knowledge, manifested by the imposition of cognitive-instrumental rationality over other forms of rationality, as well as by the supremacy of the market regulation principle over other principles, such as the state and community. Such a configuration results in the exhaustion of emancipation by regulation itself.

To solidify a culture of environmental education, Brazil took a significant normative step in 1999. Although there were earlier national documents of great importance, such as the Forest Code (Brasil, 1965) and the National Environmental Policy (Brasil, 1981), Federal Law No. 9,795/1999 (Brasil, 1999), which established the National Policy on Environmental Education (PNEA), is considered a milestone in educational public policy as it was the first legal text to address the right to environmental education exclusively. More than twenty years

after its enactment, it continues to be the primary guiding instrument in both school and non-school educational spaces (Farias; Farias, 2020).

From the perspective of the transformative potential of the relationships between human beings and nature, the National Policy on Environmental Education was constructed on basic principles such as participation, totality, complexity, interdisciplinarity, and educational praxis. These objectives incorporate a critical perspective, which constitutes the subject of discussion for current and future educational practices (Moreno-Sierra; Martinez-Perez, 2022).

Totality, therefore, is understood as a perspective of critical environmental education, which allows understanding reality as a structural whole, encompassing social, ecological, cultural, and economic dimensions. While these dimensions can be analyzed individually, they all are part of the same reality. Thus, the formation and consolidation of knowledge should occur through a continuous act of developing understanding structures of the various forms of social aspects, discussed from the path of integration through an exercise of synthesis and perception and analysis of everyday life, which must be sustainable (Orozco, 2018).

In this context, it is important to note that sustainability is verified by economically viable and socially acceptable activities, and therefore, it cannot be dissociated from the ecological, social, and economic elements, which highlight the existing social and political complexities in society (Leff, 2001; Roos; Becker, 2012). Similarly, the understanding of environmental education also permeates the everyday life context and must be viewed with a sense of totality; thus, it should also be perceived as an integral part of phenomena, not only ecological but also economic and social.

From this perspective, environmental education enables individuals to reflect on their understanding of the world and themselves, expanding their cognitive horizons through access to meaningful information, knowledge, and insights. This prepares them to face and solve life's problems better (Angelis; Baptista, 2020). The transversal nature of environmental education, essential in adult life, has also been emphasized by emerging regulations on the subject since the 1990s.

Furthermore, according to the National Policy on Environmental Education (Brasil, 1999), the educational process involves defining public policies that incorporate the environmental dimension and promote, among other actions, society's engagement in the conservation, recovery, and improvement of the environment. Generally, this law emphasizes the triad of society/nature/culture, recognizing the complexity of understanding environmental realities (Toro; Vaz, 2022).

## Non-formal Environmental Education and Wind Parks

According to the UN (2015), the treaty on Global Sustainable Development Goals represents a public agenda constructed through a global partnership for sustainable development, to be fulfilled by 2030, which seeks to "By 2030, substantially increase the share of renewable energy in the global energy mix".

Brazil, which has one of the largest sources of hydroelectric power, reinforces its commitment to the global agenda by incorporating wind parks into its energy matrix. Considering technical aspects, such as territorial characteristics, wind energy proves to be a viable and beneficial alternative for Brazil. It represents a significant challenge for the country's public management to coordinate incentives for the installation of wind farms while simultaneously ensuring attention to sustainability aspects.

However, it should be noted that the free functioning of market mechanisms, without state coordination, can exacerbate regional imbalances where the spatial polarization of development creates economic and social inequalities, leading to the emergence or worsening of tensions, social conflicts, and political and economic instability in the territories (Canuto; Cherobim, 2019).

Thus, Resolution No. 462 of July 24, 2014, from the National Environmental Council (Conama, 2014), which establishes the rules for environmental licensing for the installation of wind parks, requires among the necessary documentation, the characterization of the population, identifying existing migration patterns and the interferences on public education, health, and safety services.

Furthermore, the said Resolution expressly demands the identification of control measures that can compensate, minimize, or avoid the negative impacts of the project and also the adoption of strategies that can enhance the positive impacts. Among these measures, there must be a presentation of an environmental education program aimed at the affected communities and the workers of the parks, as well as the establishment of a participative licensing process (Brasil, 2014).

In terms of state legislation, in the State of Rio Grande do Norte, Article 4, clause VIII of State Law 6.950/1996, which established the Coastal Management Plan, declares as one of its objectives the “promotion of environmental education, an indispensable necessity for the sustainability of socio-environmental development” (Rio Grande do Norte, 1996, our translation). Thus, just like the National Policy on Environmental Education, the state policy

(Rio Grande do Norte, 2017), reiterates the postulates of sustainable development conditioned to new methodological paradigms of public policy planning that respect the environment-development linkage and the construction of environmental knowledge, supported by the principle of totality. This perspective values the subject and the transformative power of history, as defended by Freire (1987).

Environmental education can be understood as a social space that emerges at the intersection of the educational and environmental fields. These fields contribute distinct social properties and structuring logics, fostering multidisciplinarity as a beneficial element for their development. Such an approach promotes interdisciplinarity and multiprofessionalism, aligned with the complex, differentiated, and plural nature of practical training involved (Cartea; Núñez; Castiñeiras, 2017).

In this context, the principle of the totality of the National Policy on Environmental Education is embedded, which, among the initiatives, foresees not only the training of human resources but also the support for local and regional experiences, including the production of educational material (Brasil, 1999). These initiatives must integrate the environmental management of companies as an attempt to balance economic activity with environmental conservation and thus also mitigate potential negative impacts on the social and cultural environment (Giesta, 2013).

Thus, the regulations regarding licensing that mention environmental education refer to the National Policy on Environmental Education in the context of non-formal educational initiatives (Viera; Zanon, 2023). The National Policy on Environmental Education solidifies this understanding by envisioning as a non-formal educational initiative "the participation of public and private companies in the development of environmental education programs in partnership with schools, universities, and non-governmental organizations" (Brasil, 1999, art. 13, our translation).

Interpreting the mentioned article, it is evident that although it prioritizes Federal Entities as the primary agents of non-formal environmental education, the State can also implement such practices through the regulation of environmental licensing. In this context, companies are required to develop these practices in the planning and execution of environmental programs. Notably, the development of educational campaigns aimed at the population for the protection of ecological conservation units and the encouragement of sustainable management and ecotourism by farmers and traditional populations are highlighted. These are the focuses of analysis in this paper.

It is reiterated that non-formal education encompasses a process with multiple dimensions of learning, which are carried out and encouraged by a wide range of social segments, and are not limited to education experts. This includes, for example, capacity building for work through the development of skills and potentialities; the encouragement of political learning, rights, and citizenship issues; as well as fostering practices that enable individuals to organize with community objectives aimed at solving everyday collective problems, among other aspects (Catini, 2021; Saad; Vovio, 2006).

In this educational process, environmental campaigns are very important tools in preparing individuals as citizens, presenting relevant themes or problems, and proposing solutions to transform behaviors through information and capacity building for transformative action initiatives, starting from knowledge (Agência Nacional de Águas, 2023). However, it is necessary for educational campaigns to be planned in coordination with community leaders and professionals who understand and experience the challenges and potentialities of educational work in community routines (Vasconselos, 2004), notably for those living or depending on the exploitation of territories in conservation units.

According to Federal Law No. 9.985/2000, a conservation unit is defined as a territorial space and its environmental resources that have been legally established by the Public Authority with the goal of conservation within defined limits. To this end, adequate protection guarantees are applied through a special administration regime. Conservation units can be classified into two categories: Units of Full Protection and Units of Sustainable Use (Brasil, 2000).

Conservation units of full protection are characterized by rigorous monitoring and impose severe restrictions on visitor access, with the presence of human settlements not allowed. On the other hand, in sustainable use conservation units, the legal existence of human settlements is permitted, particularly those related to traditional communities. These communities must preserve their cultures while also enabling the exploitation of ecotourism (Filgueira, 2018).

Ecotourism should be understood as a segment of tourism that focuses on the natural environment, biodiversity, landscapes, and cultural aspects, always in harmony with environmental conservation. However, in the absence of adequate training and the provision of environmental education, ecotourism can result in increasing ecological impacts and/or the concentration of economic benefits in the hands of a few entrepreneurs. In addition to environmental impacts, in states of the Northern region of Brazil, it has also been noted that the lack of environmental education among residents can cause various other impacts on traditional

communities. Such impacts include significant changes in conventional activities, marginalization or even abandonment of these activities, as well as changes in cultural values. It is also observed that there is a spread of social problems such as prostitution, violence, pressures on sanitation and energy services, and inflation in land and product prices (Almeida, *et al*., 2022).

Thus, traditional communities are defined as culturally distinct groups in relation to society at large, which recognize themselves as such, and exhibit unique ways of social organization, occupation, and use of territories and natural resources, which integrate cultural, religious, social, ancestral, and economic reproduction and transmit knowledge through oral tradition (Pizzinato; Guimarães; Leite, 2019). Thus, traditional communities in Rio Grande do Norte include *quilombolas*, gypsies, *castanheiros*, artisanal fishermen, *marisqueiras*, *ribeirinhos*, *caiçaras*, *praieiros*, *sertanejos*, *jangadeiros*, *caatingueiros*, among others (Oliveira; Silva; Falcão, 2021).

Therefore, given the complexity of life and economic activities carried out in the municipality, it is not possible to predetermine or rigidify the plurality of environmental education into a single model. The challenge is to recognize the existence of multiple environmental educations in the various contexts of society and their achievements (Pereira; Freire; Silva, 2019).

The promotion of environmental education is a requirement in the licensing process for wind farms. Thus, in addition to being a source of clean energy, the installation of parks creates an expectation of broad local development. These potential positive and negative impacts, under the light of the principle of totality in environmental education, will be analyzed next.

## Methodology

This research is characterized as qualitative by systematic review technique, which is understood as a type of research that uses literature on a specific topic as a data source, through the application of systematized and explicit search methods, for critical appraisal and synthesis of the selected information (Medeiros; Vieira; Braviano; Gonçalves, 2015).

As the general objective of the research is to analyze the performance in environmental education promoted by wind farms in the municipalities of Rio Grande do Norte, from the perspective of impacts on the natural, socioeconomic, and cultural environments, searches were

conducted from 2000 to April 2023, in the dissertation and thesis databases of universities in Rio Grande do Norte: UFRN, UFERSA, UERN, IFRN, UNP, and UNIRN. Additionally, complementary research was carried out in the Brazilian Digital Library of Theses and Dissertations focusing on Rio Grande do Norte.

The choice of the research "locus" is justified by the prominent position of the state of Rio Grande do Norte in the national scenario as a leader in renewable energies, with a growing and notable potential for wind power generation. This state represents 26% of the wind farms in operation in Brazil. In absolute terms, in Rio Grande do Norte, there are 6,605 wind power projects distributed across 47 municipalities, encompassing plants already in operation, under construction, or in the licensing process (Rio Grande do Norte, 2022).

Initially, the selection of studies was conducted using the descriptors "environmental education" and "wind power," resulting in 15 studies. Subsequently, due to the limited number of results, a new search was carried out with the descriptors "development," "wind power," and "sustainability." The aim was to identify studies that, although not directly focused on environmental education, could provide data related to non-formal education activities.

Then, 76 studies were located that addressed wind energy and aspects of human development and sustainability. In a Microsoft Excel spreadsheet, for better organization and visualization of the information, the following data from the studies were saved: title, author, general objective, results, year, and access link.

Following the fourth step of the systematic review, methodological verification was conducted, leading to another stage of exclusions. In this phase of the research, only those studies that relied on empirical methodology, using qualitative techniques such as case studies or comparative analysis of municipalities in Rio Grande do Norte, were selected. As a result, 23 dissertations remained for analysis. They included: Improta (2008); Pessoa (2008); Amaral Neto. (2012); Melo (2014); Gonçalves (2015); Agra Neto (2015); Costa (2015); (Costa; 2015); Cruz (2016); Hofstaetter (2016); Oliveira Nt. (2016); Queiroz (2016); Souza (2016); Zanferdini (2016); Cavalvanti (2017); Nunes (2017); Pontes (2017); Barros (2018); Cavalcante (2018); Filgueira (2018); Medeiros (2018); Santos (2018) and Carvalho (2022).

Data were collected directly from the dissertation texts, using a direct search for keywords to verify the mention of activities stipulated by the National Policy for the implementation of non-formal education programs by companies. The descriptors used included: "environmental education," "educational campaign," "participation," "conservation unit," "traditional populations," "agriculture," "tourism," and "ecotourism".

Subsequently, content analysis was conducted using the method proposed by Bardin (2010). Initially, a pre-analysis was carried out with a floating reading of the selected works, seeking a first and general perception of the messages. Subsequently, the selected excerpts were systematically organized and displayed in a table in Microsoft Word. Afterwards, the organization, description, and interpretation of the data were carried out through systematization and comparison of the respective categories: environmental education through environmental programs, compliance commitments, and public participation; as well as through tourism, ecotourism, and agriculture.

## From the Results

Following the explanation of materials and methods, the data is presented, and the analysis of the results is conducted.

## Environmental Education through Environmental Programs

In terms of documentary analysis of commitments made by wind power enterprises, Carvalho (2022) identified in compliance documents the ratification of wind companies with activities of education and development, education, and support for local development. From a normative perspective, there are documentary requirements for democratic participation in the environmental licensing processes and the provision of environmental education. These requirements are grounded in Article 225, subsection VI, of the Federal Constitution and in the National Policy on Environmental Education, established by Federal Law No. 9.795/1999 (Brasil, 1999). At the state control level, as already mentioned in the normative reference, the Institute of Sustainable Development and Environment (IDEMA) requires an environmental education plan during the licensing process for the construction of wind farms. It is important to highlight that all companies formally present environmental education programs in compliance with the legal requirements.

Costa (2015) and Medeiros (2018) confirmed that companies responsible for wind farms carry out socio-environmental programs, executed during the installation and operation phases of the parks, tailored to demands required in environmental licenses. One of the most common programs is the social communication program, which can encompass ecological education, and outlines plans and projects to be developed for the community within the area of influence. This is because the companies seek justification for sustainability, understood as the association

of socially acceptable activities, considering ecological, social, and economic factors (Leff, 2001; Roos, Becker, 2012).

However, there were found to be contrasting views among state and municipal managers regarding the effective implementation of these environmental education programs. Such programs were described by Costa's (2015) interviewees as ranging from investments in permanent infrastructure, such as the construction of schools in settlements, to actions considered as "temporary gifts from the wind farms to local residents," which often do not extend beyond sponsoring festivals and championships or donating toys (Costa, 2015, p. 108, our translation).

Medeiros (2018), in turn, observed that during the licensing process, one company committed to implementing a communication plan to engage with the community and provide environmental education through community meetings. However, the last meetings were canceled and replaced exclusively by the distribution of pamphlets. In this context, Costa (2015) verified in her research that, indeed, no educational campaigns were conducted about the introduction of wind farms, their activities, and their environmental, social, or cultural impacts. This lack of action severely compromises the realization of environmental education, which is essential for the formation of the ecological subject (Angelis; Baptista, 2020; Cavalcante, 2018).

It has been reported that through social communication programs and with the support of city halls, companies have conducted lectures and campaigns about sexually transmitted diseases, contraceptive methods, and combating child sexual exploitation and abuse. The justification for conducting such campaigns stemmed from a significant increase in sexual violence, child sexual exploitation, teen birth rates, and rates of sexually transmitted diseases during the installation process of the parks, which generate a seasonal increase of workers in the municipalities (Costa, 2015; Cruz, 2016; Hofstaetter, 2016). Additionally, vaccination campaigns for people and animals were also conducted (Gonçalves, 2015).

Criticism has been raised regarding these campaigns for not being well-developed and planned, because, as a rule, they are conducted by engineers from the central administration of the wind sector, based in the Southeast region, who are unfamiliar with the particularities of each municipality in Rio Grande do Norte and create campaigns that are disconnected from local realities or culture (Costa, 2015). Thus, the data gathered leads to the understanding that there is non-compliance with non-formal education as a process with numerous dimensions of

learning, aimed at citizenship (Catini, 2021) and the formation of the ecological subject (Carvalho, 2013).

Only two of the researched works, Santos (2018) and Nunes (2017), found that educational campaigns specifically related to the installation of wind farms were conducted. However, in both cases, such campaigns were promoted due to the leadership of other social actors involved in the context. Santos (2018) reported that, in a few coastal locations, environmentalist groups conducted campaigns with the population to reject the installation of parks in dune areas.

Nunes (2017) noted the role of INCRA, which conducted a campaign favorable to the installation of the parks to convince local communities, amid complaints and mistrust caused by deficient and insufficient information provided to the population during the environmental licensing process, as well as the lack of popular participation and public opinion inclusion to discuss gains and losses in the installation of the parks. INCRA's role was also highlighted by Hofstaetter (2016), who clarified that when the lands leased to wind enterprises are owned by INCRA, the entire settlement benefits, as this entity carries out projects for the collective use of resources.

In light of the data presented by the authors concerning the shortcomings in the realization of environmental education programs, Santos's (2000) concern becomes evident. He challenges the positivist idea that regulatory measures alone are sufficient to achieve social emancipation and democratic strengthening. Instead, it is essential for society to strive for the improvement of control mechanisms and social participation. This will be discussed in what follows.

## Environmental Education through Compliance Commitments and Public Participation

The adoption of commitments in compliance documents includes the creation of participation channels for all and the fostering of dialogue spaces with the support of managers (Carvalho, 2022). Significant events, such as meetings with governmental managers, investors, and service providers in the wind energy sector, featuring dozens of speakers and oral communications, have taken place in Natal (RN) to debate and clarify issues related to the impacts of wind farms. For example, the National Wind Forums held in 2016 and 2017, and the State Forum of Renewable Energies of Rio Grande do Norte, served as platforms for environmental education activities (Barros, 2018). The central issue is whether these debates,

reflections, and knowledge have reached the local populations, ensuring that individuals are respected regarding their transformative power over their history, through a dialectical relationship experienced in their interaction with nature and culture (Freire, 1987).

Medeiros (2018) found that in the municipalities he analyzed, there were no campaigns but meetings to clarify the construction of the park. It was noted that local population attendance was lacking, with only 50% of the affected population attending public hearings. Similarly, Barros (2018) observed that no meetings occurred in the settlements directly impacted by the wind farms, as discussions were held in public hearings at the City Council chambers of the municipalities. There were no flyers, posters, or loudspeakers advertising these hearings in the settlements, resulting in consistently modest participation from local populations. This finding supports Santos's (2003) argument on the necessity for knowledge as a means of emancipating the individual, emphasizing that participatory democracy needs to be strengthened, as regulatory knowledge alone is insufficient to realize the ideal of forming the ecological subject (Cavalcante, 2013).

Other reasons for low public participation include: the absence of representatives from wind energy companies in the localities, making it impossible for the population to contact the managers; lack of commitment from municipal managers and wind companies; difficulty for residents to travel to meetings; lack of organization within society; and the belief that there are no real spaces for expressing opinions (Hofstaetter, 2016; Improta, 2008; Medeiros, 2018; Queiroz, 2016).

The only exceptions regarding data on public participation were noted in the work of Cavalcante (2018), which concluded with inconclusive results due to a lack of consensus among interviewees on this issue, and Gonçalves (2015), who noted that the wind farm project sought to negotiate the interests of farmers with renewable energy investors and local governments.

Community participation is crucial for the joint formulation of desirable social, economic, and environmental indicators during the implementation of wind parks. An example of this need was the report that social groups affected did not participate in the discussion and installation processes of wind farms. There is the case of a town where the local population was not consulted on the most appropriate location for installing a wind park, which negatively impacted the production of honey, one of the main economic activities of the municipality (Gonçalves, 2015; Hofstaetter, 2016).

Thus, awakening the importance of behavioral change through environmental education is essential to empower the population and enable the formation of the ecological subject both

in terms of the community and the company itself (Cavalcante, 2013). Proposing conditions for the population to actively participate in decision-making about wind parks is essential for all parties involved: companies, the state, and society (Hofstaetter, 2016).

It has been observed that, although there are already difficulties for public participation during the licensing process and in promotional, and educational tools, Improta (2008) noted that after the completion of the installation works, there is an even more significant and widespread reduction in the population's involvement with the wind park and in discussions about how the community can interact with the managers of the enterprises. The consequences also negatively impacted the economic sphere, hindering the development of agricultural, livestock, and ecotourism activities, affecting the way of life of traditional populations, and redefining the use of territories.

Thus, valuing the culture and social identity of a community permeates social participation, where it must involve engagement and struggle on the part of society as a project of social inclusion and cultural innovation, elevating the perspective of the realization of democracy (Sousa, 2003). Environmental education is shown to be fundamental in order to preserve and value the occupations of traditional communities, grounded in sustainable economic development, which will be analyzed next.

## Environmental Education through incentives for Tourism, Ecotourism and agriculture activities

Regarding the implementation of ecotourism activities in environmental reserves and conservation units, it should involve a joint analysis of expectations and interests, clearly defining the role of this sector as an active player in the process, and the technical adequacy to plan means to facilitate, monitor, and minimize the impacts of these activities. Thus, negative impacts can be transformed into positive ones if there is community participation in energy cooperatives (Cruz, 2016; Filgueira, 2018; Pontes, 2017) and broad access to and encouragement of environmental education programs.

However, it has been depicted that wind parks have disrupted natural beauties, potentially harming tourism, especially in dune areas, and even depreciating activities such as tours (Hofstaetter, 2016; Melo, 2014), despite their recognized potential as an additional tourist attraction (Santos, 2018).

Regarding interactions through ecotourism in conservation units, it is possible to see that results can be satisfactory for both visitors and traditional communities. This requires proper planning, analysis, and engagement of public authorities and communities (Filgueira, 2018). The impacts on municipalities affected traditional populations not only in ecotourism. Due to the extensive areas occupied by wind parks and intense real estate speculation, there has been a reconfiguration of spaces previously dedicated to livestock and family farming (Improta, 2008; Queiroz, 2016).

This perception corroborates the one depicted by Almeida *et al.* (2022) that the absence of environmental education can lead to other types of impacts on traditional communities, such as significant alterations, marginalization, or even the abandonment of traditional activities or changes in cultural values.

Regarding the issue of family farming and the way of life of traditional populations, it has been found that wind parks lease land to owners. This enhances access to income in areas with limited agricultural productivity. Moreover, the installation of wind parks on properties of family farmers can ensure income for these families for a prolonged time, especially due to the difficulties in maintaining traditional agriculture due to climatic factors such as prolonged droughts (Costa, 2015), which is very positive, considering the mitigation of negative impacts on the social environment from an economic perspective (Giesta, 2013).

However, in parks installed in rural areas and not in settlements, the problem of readjusting agriculture and job loss arises, so many farmers from these municipalities in less arid zones believe that the land is negatively impacted by the installation of the parks. There is a belief in an unfair distribution of gains and profits between landowners and non-landowners (Cruz, 2016). It is even reported that some rural properties were harmed in their agricultural activities by the parks due to changes in the fauna and flora of the municipality and, as they were not included in the areas directly sheltered by the leased lands, they received no compensatory payment (Souza, 2016). There has even been a legal case initiated by farmers to prove that the installation of the parks had made agriculture and hunting, which are subsistence activities of the local communities, unviable (Nunes, 2017).

Therefore, in cultural terms, it has been found that the construction of wind parks in various municipalities has led to changes in the traditional way of life of the communities, resulting in their impoverishment. This scenario triggered various reactions among the affected inhabitants. In most places, socio-environmental conflicts between communities and companies and the emergence of social movements against the parks were identified (Queiroz, 2016;

Souza, 2016). In others, however, there was a lack of evidence of rejection by the residents, who merely see it as neutral to their lives, yet reported the absence of projects and/or programs to raise awareness about the importance of environmental protection (Improta, 2008).

In terms of fostering the discussion of environmental issues in society, among traditional populations and farmers about the importance of conservation units, Gonçalves (2015) found that "almost 100% of the interviewees had never received any training or education on environmental education," which contradicts the teleological perspective of environmental policy on the formation of an ecological subject, as conceptualized by Cavalcante (2018).

In this context, Cavalcante (2018) notes that environmental education was cited by 261 out of 300 people interviewed in the municipality of Areia Branca as an essential measure to be developed by the Public Authority to improve the coastal area. He also found that environmental education is indispensable in the process of reflecting on a change of attitude in society, making it participative and aware of the severity of environmental impacts and the urgency in developing actions for the sustainable management of natural heritage.

Cruz (2016) proposes, as an essential measure for municipalities to adopt, projects that involve environmental education for residents to empower them and teach them about animal breeding and plant cultivation in harmony with wind towers. In addition, research was conducted on reducing the negative impact on crops of some species, such as cashew trees, and the effects on birds, aiming to propose new habitats and reduce damage or even prevent the extinction of species. These issues corroborate the damages described by Dias (2010), who emphasizes the lack of attention to environmental education and the negative impact that the absence of social participation can have on the economic process.

The lack of environmental education programs is recognized, despite existing initiatives. To enhance ecological education through exploration, a visitor center could be established as a means to attract tourists and provide environmental education to students. As an example of a positive initiative, an environmental education project aimed at ecotourism and understanding the impacts of wind parks in the municipality of Rio do Fogo is mentioned (Filgueira, 2018; Improta 2008).

From the above, it is unfortunately evident that in the realm of the wind parks in Rio Grande do Norte, there are still many deficiencies in complying with the National Policy of Environmental Education to ensure its interdisciplinary, multifaceted, and holistic concreteness, which could decisively contribute to promoting the necessary shifts in humanity's course as theoretically described by Dias (2010).

## Final considerations

This study aimed to analyze the activities of non-formal environmental education promoted by the wind parks in the municipalities of Rio Grande do Norte, considering their impacts on the natural, socio-economic, and cultural environments. The analysis was conducted through qualitative research using the systematic literature review method. After four stages of searching and eliminating studies, dissertations published between the years 2000 and 2023 were selected for data collection.

Regarding the first specific objective, which concerns educational campaigns, it was observed that no campaigns were conducted under the initiatives of the enterprises themselves regarding the introduction of wind energy, its activities, and environmental impacts. There were no significant efforts to raise awareness about the importance of preserving conservation units. Moreover, the actions proved predominantly controversial regarding the promotion of ecotourism and the training of local professionals.

It was also found that farmers and traditional communities faced difficulties participating in public hearings during the licensing process, in addition to reports of loss of income access by small producers who sold their land, increased tension, and concentration of income in rural areas.

Regarding the second specific objective, it was found that wind power enterprises, although formally maintaining environmental education programs to meet legal requirements, neither plan nor execute these programs in a way that addresses the specificities of local communities. This contributes to the amplification of significant adverse impacts in the social, economic, and cultural contexts of traditional populations.

The lack of effectiveness in environmental education programs and social participation, especially in discussions about the impacts of wind power activity, was also noted. This inefficiency is not limited to the environmental licensing process but also extends to the period after the start of activities.

In light of all that has been presented, it is concluded that the data indicate the need for the effective implementation of environmental education programs and increased monitoring by public authorities and society in general, so that positive experiences can be shared and negative ones can be discussed and addressed to achieve a positive social reversal.

Finally, it is clarified that although it was not the methodological focus, the absence of direct data collection using instruments such as focus groups or interviews, particularly with

traditional populations and with public managers and wind power enterprises, proved to be a weakness of this research. Therefore, as possibilities for future studies, the materials and methods should be expanded to allow for data triangulation.

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