

Wind-energy Development Causes Social Impacts in Coastal Ceará state, Brazil: The Case of the Xavier Community



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ABSTRACT

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A significant increase in wind-power generation has occurred since 2008 in coastal regions of northeastern Brazil. Many wind farms have been erected on territories claimed by traditional communities, which have suffered changes in how they obtain resources as a consequence. Here we study the Xavier community, a settlement of 20 families and 66 people, located in the Camocim municipality of Ceará state. Xavier residents subsist on extractive activities such as artisanal (non-mechanized) fishing, shellfish collection, and crop cultivation. But in 2009 one of Ceará's largest wind farms was established approximately 200 meters from the settlement. Although some may see these projects as low impact, wind farms in Ceará are being implemented in areas that are environmentally unstable, located within territories claimed by traditional communities, negatively affecting their livelihoods. This paper analyzes the social impacts caused by the establishment of the wind farm through participant observation, group workshops, and analysis of textual materials. Several problems are described, including the absence of basic infrastructure and employment; road blockages; privatization of common resources; noise from turbines; constant fear of accidents involving turbines; internal conflicts among Xavier residents caused after the implementation of the wind farm; and burial of lakes. Wind-farm construction negatively influenced this traditional community by threatening territory, cultural traditions, and food security.

ADDITIONAL INDEX WORDS: *Wind energy; traditional communities; environmental impacts.*

INTRODUCTION

Wind-energy development in Brazil was implemented rapidly in response to an electricity crisis in 2001 (Juárez *et al.*, 2014). Wind farms have clustered in coastal areas, especially in the northeastern region. Many residents of Brazil's coastal environments rely on small-scale resource extraction (fish, shrimp, crops) and are considered "traditional communities" as defined in Brazilian law (see Decreto N° 6.040, de 7 de fevereiro de 2007). In Ceará, a state in northeastern Brazil, wind power has been installed rapidly in coastal environments that are dynamic and fragile, highly vulnerable to human activities (Gorayeb *et al.*, 2005; Vasconcelos, 2005). Wind-power generation, a desirable clean energy source capable of supplying more than 40 times current electricity demand (Lu *et al.*, 2009). Firms and political elites justify wind-energy projects on the bases of needed electricity production and improved quality of life. However, scholars have observed social-environment and territorial problems resulting from wind-energy development in traditional communities (Brown, 2011;

Meireles *et al.*, 2013). Here we report social impacts of wind power on the Xavier community, a traditional settlement of 20 families (66 residents) relying on artisanal fishing, shellfish collection, and small-scale farming (Figure 1).

Installed wind-power capacity in Ceará has increased by nearly 238% since 2010, when 17 wind farms capable of producing 518,934 KW were located in coastal areas (ADECE, 2010). In 2015, 44 wind farms were operational, capable of producing 1,233,234 KW, bring total installed capacity to 2,847,234 KW (ANEEL, 2015).

In Ceará, wind farms have been located on highly unstable coastal areas, such as active sand dunes, estuaries, and beaches (Gorayeb *et al.*, 2005; Vasconcelos, 2005), where human populations cluster. These traditional communities are comprised of fishers and marine resource users, *quilombolas* (descendants of runaway slaves who formed free settlements in opposition to slaveholding farms), family farmers, and indigenous peoples. Livelihoods and access to resources in traditional communities have been negatively affected by changes to the physical environment (Meireles, 2011). Wind farms are among several large coastal development projects that have created serious and complex disputes and loss of territory claimed by traditional communities (Primavera, 2005; Simas and Pacca, 2013; Valiela *et al.*, 2001).

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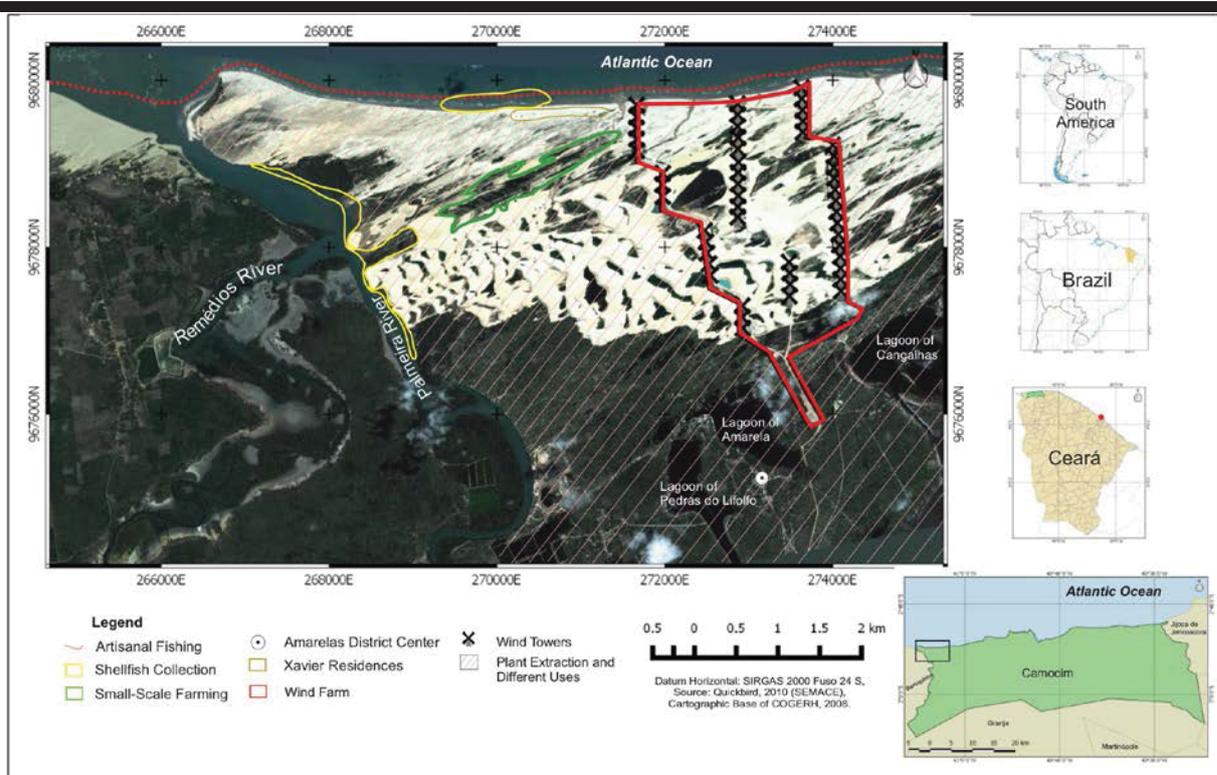


Figure 1. Location of the Xavier community, in western of Ceará, Brazil.

Frequently, wind farms in Ceará are built in areas without infrastructure or public services. Our field work suggests that wind developers use this fact to persuade political and economic elites and regulatory officials regarding potential benefits of their projects. Wind-farm developers also have tried to obtain support from traditional communities by promises of compensatory measures and permanent employment (Brown 2011), which is an illusory pledge because most employment is temporary, during the construction phase. In other areas of wind-power development, such as the USA High Plains, employment from wind power offers tangible benefits and relatively high salaries compared to other opportunities (Slattery *et al.*, 2011).

Globally, most social conflicts regarding wind farms have been reported in North America and Europe. Main causes of opposition to wind farms have been synthesized by Pasqualetti (2011) and Bell *et al.* (2013). Wind farms may represent an imposition to the attachment of people to landscapes. Host communities may feel marginalized because they did not participate in planning decisions or because they receive few benefits, and people may complain of health effects. On the other hand, high support for wind power has been reported in areas where the economy has been declining and landowners receive royalties from wind-power production (Brannstrom *et al.*, 2011; Slattery *et al.*, 2012).

However, little is known about wind-power conflicts in developing countries. Brown (2011) described the opposition

movement and the response of the wind-power industry in one well known one site in Ceará. He argued that wind-power firms could mitigate negative impacts, but did not analyze possible impacts of compensatory measures.

Several studies, such as Meireles (2008, 2009), Meireles *et al.* (2013) and Meireles *et al.* (2015), describe environmental impacts from wind-farm construction.

Mitigating measures and alternative sites for locating wind farms would minimize negative social impacts from wind energy development (Carrete *et al.*, 2012; Kikuchi, 2008; Kunz *et al.*, 2007; Landry *et al.*, 2013; Lucas *et al.*, 2012; Mirasgedis *et al.*, 2014; Munday *et al.*, 2011; Schläppy *et al.*, 2014; Slattery *et al.*, 2012).

Ceará “is a bellwether in the debate over how grid-scale renewable energy can grow sustainably in the developing world” (Brown, 2011, p. 357). We build on this work by analyzing dynamics in a less well known site and by considering the impacts of mitigation or compensatory measures offered to a traditional community. The findings we and others report indicate the importance of policies to assure the territorial integrity of traditional communities in coastal regions.

METHODS

Our research included participatory diagnosis of participant observation, group workshops, transect walks, construction of a problem-potential matrix, collective discussion regarding land-

use planning, and analysis of textual materials. During group workshops, we collected information on environmental problems, physical and psychological discomfort, and social impacts of the wind farm from the perspective of community residents. Transect walks resulted the definition of environmental characteristics of community territory and description of environmental impacts discussed during group activities. Collective discussions, using participatory methodology, were synthesized into main positive and negative effects of the wind farm on the community's traditional territory. Field work for participatory diagnosis in 2014 and 2015 consisted of meetings with 20 community representatives between 12 and 65 years of age, allowing for obtaining different views of the community's territory. Other research tasks were carried out between 2010 and 2013, including visits to the areas surrounding the community, analysis of the wind farm, observations of landscape changes and changes in daily life in the community, and observations of community member relations with the wind farm and surrounding area.

RESULTS

In 2009 one of Ceará's largest wind farms, 50 turbines with capacity of 104.4 MW covering 1,040 hectares, was constructed around 200 meters from the extreme east of a linear settlement of houses in Xavier. The wind farm created several social and environmental problems, including: (i) roadblocks denying physical access of Xavier residents; (ii) privatization of common resources; (iii) discomfort from the noise that turbines generate; (iv) constant fear of an accident involving the turbines; (v) continued absence of public services (transport to school, sanitation, collection of garbage, access roads, health care) and employment; (vi) internal conflicts among Xavier residents caused by divisions resulting from the mitigation measures offered by the wind-energy firm; (vii) burial of lakes and reduction of fish supply.

Xavier residents suffer from a food deficit because they are unable to access fish in former lakes. These lakes were used for artisanal fishing when residents were unable to fish in the Atlantic Ocean because of fish scarcity or because fishing was prohibited (e.g., lobster or Red snapper).

Xavier lacked electricity until one year after the wind farm was erected. Residents described many legal disputes, negotiated through the public prosecutor (*Promotoria de Justiça*; see Mcallister, 2008) of Camocim to ensure that power lines would reach the community because the wind farm impeded access to the electricity transmission route.

Other legal disputes challenged the wind farm. Among the more important was the road built by the wind firm to reach the wind farm. The road provided access to the turbines, necessary for maintenance, and is today the only road that provides access to Xavier. However, access is restricted by a security gate with armed guards working for the wind-farm operator. During approximately two years, Xavier residents were prohibited from passing through the gate, impeding daily tasks such as selling fish, going to school, and accessing health care.

A community association obtained mitigating measures from the wind-farm operator after lengthy negotiations. The following benefits were conceded: (i) authorization to install electricity lines for the Xavier community in 2010; (ii) access to

the road linking the wind farm and the nearest house in 2010, made official by a legal agreement (*Termo de Compromisso e Obrigações Mútuas*) in 2013 (iii) social work such as screening environmental videos and animated films in the community in 2013; and (iv) donation of R\$540,000 (US\$130,000 at early 2015 exchange rate) for construction of 22 houses made of brick for each family in Xavier, replacing one-room huts built with mud, wood, and thatch (known locally as *taipa*, or wattle-and-daub construction), and a closed structure for both a freezer for storing fish and headquarters of the community association in 2013 (also made official through a *Commitment Agreement Termo de Compromisso e Obrigações Mútuas*).

These legal agreements, negotiated among the public prosecutor (*Promotoria*) of the Camocim municipality, the community association (*Associação dos Moradores de Xavier*) and the wind-farm operator, describe the terms for mitigating the impact of the wind farm and remove the wind-farm operator from any responsibility beyond supplying funds. Thus, the firm was not responsible for legal, accountancy, architectural, or engineering support for the construction of the new houses. This limit on responsibility made it difficult to use the financial resources because the community association, which was unprepared for this responsibility, had to manage the project.

In 2009, the residents of the Xavier community were unanimous in opposition to the wind farm. This community-wide view lasted until the middle of 2014, after the investment of the housing fund used to mitigate the negative impact of the wind farm. We estimate that half the community members changed their view of the wind farm from negative to positive. This change created internal conflict even though all families, have strong family and social inter-relations. Some families now want to sell their houses to outsiders, while others strongly resist selling, fearing the disintegration of the tight-knit community.

Community members report some improvements resulting from the wind farm. For example, the access road through the wind farm—after residents were permitted to use it—provided access to nearby houses. Electrification was impeded by the wind farm, but the construction of the wind farm also provided new arguments for this public investment. The irony of a small community, in the shadow of a large wind farm, lacking electricity was likely too much for local elites to bear. With nearly 75% of houses made of wattle-and-daub before the construction of the wind farm, the funding for brick housing was a large improvement.

Residents of the Xavier community perceive that their social and natural environments have much potential that could help bring financial and material benefits to the community and alleviate internal tensions. In particular, income-generating activities for young people are important because the Xavier's youth attend elementary school in a nearby (4 km) urban center but do not have professional employment opportunities.

DISCUSSION

Meireles *et al.* (2013) described environmental impacts of the wind farm in Xavier, noting the importance of the burial of lakes among dunes to build access roads to the turbines. Other noted impacts included: (i) removal of vegetation on stable dunes for the construction of roads and the use of heavy machinery; (ii)

destruction of fixed and mobile dunes to flatten land for the erection of turbines on dune fields; iii) interrupted fluxes between river and lake systems; and iv) soil compaction during the construction of access roads, work sites, and storage areas.

The Xavier case shows how rejection of wind-power development may be related to the presence or absence of royalties from electricity generation. Unlike cases of wind energy in the midwestern USA, where public support for wind power is high (Brannstrom *et al.*, 2011; Slattery *et al.*, 2012), Xavier residents do not receive royalties. This case fits Pasqualetti (2011) example of imposition as a key reason for opposition to wind power. However, Xavier residents received mitigating measures in the form of financial resources for new housing construction, which increased the acceptance of wind power.

Even if community members appreciate the electricity and improved housing, the modifications to the natural environment and changes to traditional livelihoods were severe. The end of access to lakes in the dune fields negatively affected livelihoods because there is no substitute for this activity.

The social and environmental conflicts relating to wind power in Xavier are not isolated or unique. Other traditional communities in Ceará display similar characteristics. For example, scholars studying the Cumbe community in eastern Ceará report complaints about heavy truck traffic, limits on human mobility, and modification of the natural landscape from the levelling of dunes and burial of lakes to build wind farms (Brown, 2011; Galdino, *et al.*, 2014; Pinto *et al.*, 2013). Pinheiro *et al.* (2014) report conflicts with extractivists in a site near Camocim, where erection of a wind farm impeded access to communally held areas used to collect the mollusk *Anomalocardia brasiliensis*. Conflicts also resulted from kitesurfing by foreign tourists, hotels, and a shrimp farm. These conflicts have reduced territories available for fishing and mollusk extraction among families, which reduced food security. Families are forced to travel an additional 1 km daily between residences and extraction areas. Evangelista *et al.* (2013) report that the establishment of a wind farm in Praia das Fontes (eastern coastal Ceará) and ensuing landscape modifications, including a concrete wall separating houses from resources, changed daily routines.

CONCLUSIONS

Private firms and public officials have supported the establishment of large wind farms in coastal Ceará and other areas in northeastern Brazil. The importance of wind power for Brazil's electricity grid is potentially large, but the continued establishment of wind farms in ways that threaten environmental resources and livelihoods will generate more social, political, and legal conflicts.

The erection of wind farms in coastal areas, especially in traditional communities, will cause and exacerbate socio-environmental conflicts that center on the decline of traditional activities, which may negatively affect livelihoods, food security, and cultural traditions.

The main problems observed in Xavier include the blockage of roads (prohibition of physical access), discomfort among residents from the noise of turbines, privatization of common areas, constant fear of accidents involving turbines, lack of

public services and employment, and burial of lakes. Mitigation measures are thought to be a way reduce social opposition and address negative impacts, but they created new internal divisions in the Xavier community. This shows that impacts from wind farms may go beyond visible impacts to the landscape. Unintended changes to pre-existing cultural and social patterns and processes may result. The Xavier community does not have sufficient political support to assure the maintenance of quality of life in its current environmental setting. Indirectly, the wind farm may encourage the privatization of communally held lands and resources and the eventual disintegration of the community. The case shows the need for detailed planning in the siting of wind farms, with special concern for communities lacking political power, before siting decisions are made. These considerations may reduce the negative social impacts caused by wind farms.

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