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Research Letters

Blown in the wind: bats and wind farms in Brazil

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ABSTRACT

The number of wind turbines in operation in Brazil will triple in five years, raising concern for the conservation of Brazilian bats. We analyzed the status of bat species richness and occurrence in areas with high wind potential in Brazil. By crossing datasets on species records and wind potential we identified 21 hotspots and 226 data gap areas. Overall, 70% of the areas with the highest wind potential are data gaps, lacking elementary information about species presence. Current Environment Impact Assessments system for wind farms in Brazil has relaxed regulations and questionable effectiveness. Environmental agencies should require *de facto* Environment Impact Assessments in data gap areas, with technical rigor proportional to the investment under course. At least for bats, the Brazilian wind power sector must raise the bar, adopting a more rigorous licensing. Alliances to minimize bat mortality at wind farms are necessary and this goal should be pursued in Brazil.

Introduction

Wind power generation is a major source of renewable energy and has gained increasing attention due to lower greenhouse gases emissions (Jacobson, 2009). The installation of hundreds of wind farms in different parts of the world has brought the need to assess the impact of wind turbines on bats (e.g. Kunz et al., 2007a; Rodrigues et al., 2008). Such studies indicated the occurrence of collisions with blades and towers, causing the death of animals in several countries (e.g. Arnett et al., 2008; Baerwald and Barclay, 2009; Hayes, 2013). Towers can reach heights equivalent to 30-story buildings, blades cover large areas when moving, and larger turbines can reach the airspace of migratory bats (Barclay et al., 2007; Voigt et al., 2012). Some studies have shown that while bats collide with other man-made structures, the frequency and magnitude of these collisions are minor when compared to collisions associated with wind turbines (Arnett et al., 2008).

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The current knowledge about the causes of bat collisions with wind turbines is unsatisfactory (Kunz et al., 2007a), but the cumulative effects of this mortality can have significant impacts on long-term populations of species affected (Kunz et al., 2007b; Arnett et al., 2008). Bats are long-living, low reproductive rate organisms, projecting a slow population growth and limited ability to recover from population declines, increasing the risk of local extinctions (Arnett et al., 2008). In fact, the American Society of Mammalogists points to the imperative need of scientific studies pre- and post-installation of wind farms (Arnett et al., 2008).

Wind energy production is now booming in some biodiversity rich tropical countries (WWEA, 2013). This is the case of Brazil. Although the country relies mainly on hydroelectricity, the *Atlas do Potencial Eólico do Brasil* (Amarante et al., 2001) indicates more than 71,000 km^2 with wind speeds suitable for power generation, with an estimated potential of 143 gigawatts (GW). Currently, wind energy accounts for only 2% of the electricity produced in Brazil, with a vast potential for growth in the country. The Brazilian government has been promoting the installation of new wind farms, and the construction of new parks is in full speed. Currently in Brazil there are at least 119 wind farms in operation, producing about 2.8 GW (ABEE, 2013). The prediction of wind power installed for the country is 8.7 GW in 2017 (ABEE, 2013), indicating that the number of farms and turbines in Brazil will triple in the next five years.

The knowledge on the impacts of wind turbines on bats in Brazil is very scarce, usually restricted to gray literature (Sovernigo, 2009; Rui and Barros, 2012). With a rich and diversified bat fauna (nearly 180 species – Paglia et al., 2012), the interaction with wind turbines is already considered one of the 10 most relevant issues for the conservation of bats in Brazil (Bernard et al., 2012). To document the existence and patterns of bat fatalities associated with wind farms is critical to (1) better understand this interaction and classify its environmental impacts as neutral or negative, (2) quantify and qualify environmental impacts so far little measured in the country, (3) contribute to the local and cumulative mitigation of impacts on the flying wildlife, and (4) generate quantitative and qualitative data useful for improving the environmental licensing of future wind projects in the country.

We analyzed the status of bat species richness and occurrence in areas with high wind potential in Brazil. We address

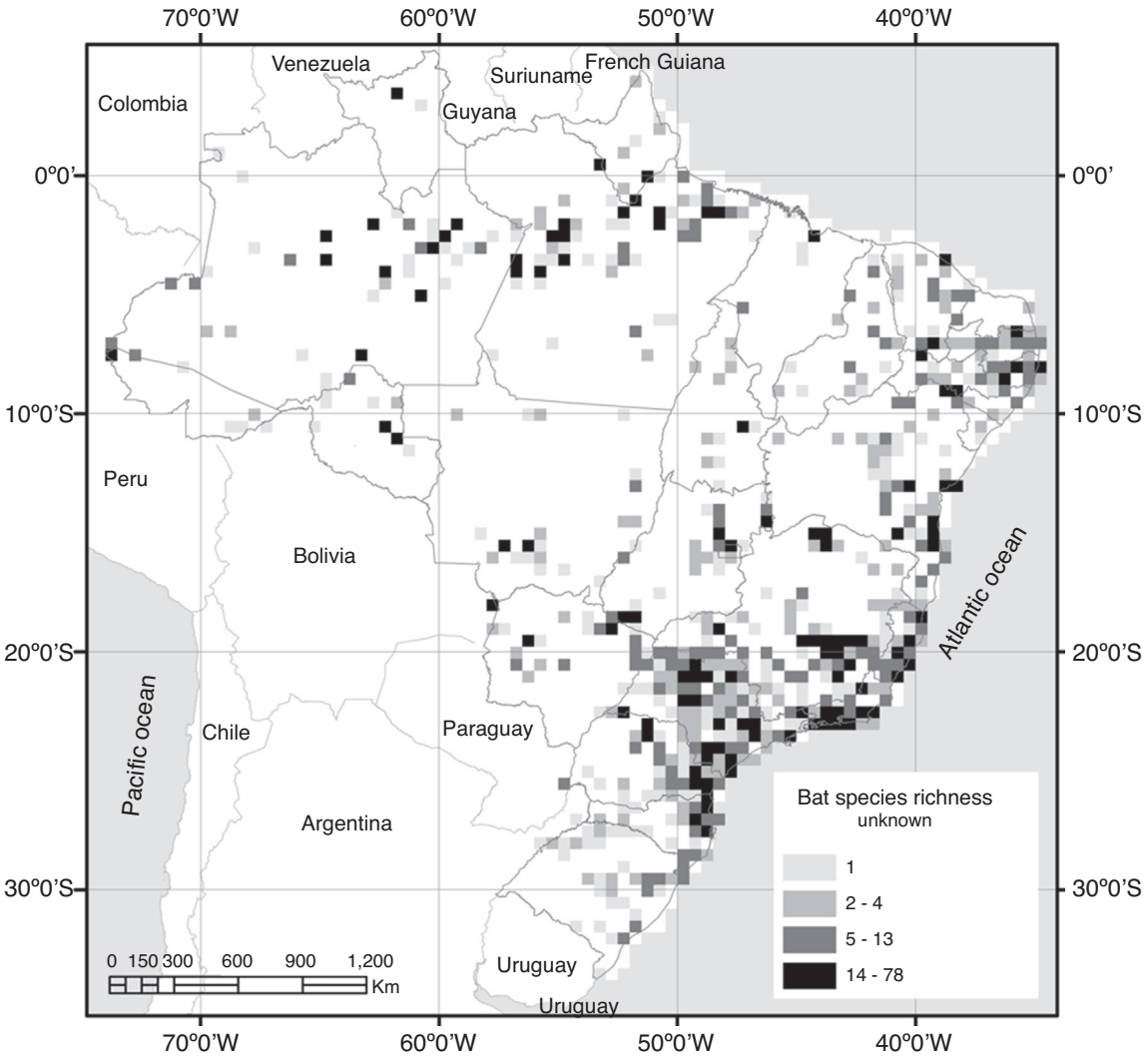

Fig. 1 – Bat species richness in Brazil grouped in cells with 0.5° of latitude x 0.5° of longitude.