



United States
Department of
Agriculture

Forest
Service

International Institute of
Tropical Forestry

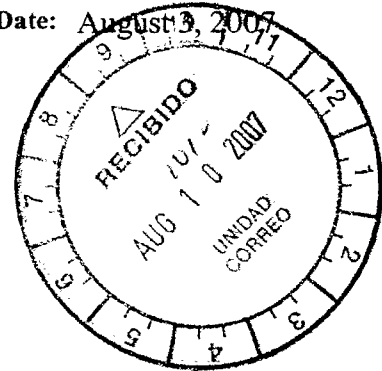
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Date: August 3, 2007

Ángel David Rodríguez
President
Puerto Rico Planning Board
Apartado 41119
Estación Minillas
San Juan, Puerto Rico 00940-9985



Re: 2006-61-0536-JPU

Dear Mr. Rodríguez:

Enclosed is additional documentation requested by the proponent which is now being submitted for the record on the above referente preliminary environmental impact statement.

Sincerely,

ARIEL E. LUGO
Director

Cc:
Lcda. Vanessa García, JP

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Date: July 30, 2007

Mr. Victor Luis González
Windmar Renewable Energy
Puerto Rico

Dear Mr. González:

Thank you for the opportunity to answer your questions regarding the ten-point presentation that I made on behalf of the Forest Service at the Public Hearing of the Puerto Rico Planning Board. The hearing dealt with a proposed zoning change to accommodate wind turbines or windmills in lands adjacent to the Guánica State Forest (Public announcement of April 17, 2007). You have sent numerous queries to the Washington Office of the Forest Service concerning this presentation and the Chief has asked that I respond.

Our testimony to the Planning Board raised ten issues for the consideration of the Planning Board in their deliberations and decision-making process. It was motivated by our concern for the stewardship of the public lands of the Guánica Forest. This was amply described in the first paragraph of the testimony that I need not repeat here. You question the authorship of the presentation and the reason why we did not participate in other venues where your proposal was discussed. I authored the testimony and I became aware of your proposal when the announcement for the public hearing appeared in the newspapers. Our two wildlife biologists with relevant expertise in the avian issues raised by your proposal were not formally invited to participate or comment on the effects of your proposals on migratory birds. I could not substantiate your claim that they were invited but elected not to participate (your message of July 19, 2007 to Mr. Mark Rey; although you contradict yourself in your message of July 19, 2007 to Dr. Ann Bartuska indicating that the Forest Service participated in the evaluation of avian impacts- point 2 below).

You ask if the research that we used for the ten-point presentation was Forest Service Research. As it turns out it was, but it does not have to be. A primary function of Forest Service Research is the synthesis of scientific data to inform the public about complex scientific issues. Such synthesis of information must draw on the whole body of the science literature if it is to be credible and effective. I will next respond point by point to your queries of July 19, 2007 to Dr. Ann Bartuska regarding our public hearing testimony and in so doing demonstrate that the information in the DEIS missed critical scientific information regarding the vulnerability of the ecological systems of the Guánica Forest to your proposal. I will use the same numbers that you used in your message to identify your concerns. **Bold** words correspond to enclosures to this letter.

1. The information on the area of dry forests in Puerto Rico is from Helmer et al. (2002). Dr. Helmer is an Institute scientist with remote sensing expertise. She is responsible for the original

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data layer used in the publication that you use to question our estimate of dry forest area. We used the information in the published version of the data and we were careful to differentiate between limestone dry forests (the ones impacted by your proposal) and dry forests in other geologic substrates in the island. These data were updated in Lugo et al. (2006). The publication you quote combined the original data provided by Helmer for the purposes of The Nature Conservancy, but they did not disclose how the information was combined. This is probably why the numbers of The Nature Conservancy that you used differ from the ones I used.

2. Almost half of the avifauna of Puerto Rico is migratory. **Table 1** contains data that show the prevalence of migratory species in capture and recapture data in Puerto Rico and other Caribbean islands. The Forest Service has a long history of interest in the conservation of Neotropical migratory birds, particularly through the *Partners in Flight Consortium*, of which we are members as are other non-governmental and conservation organizations. As we pointed out in our testimony to the Planning Board, we have been capturing, banding, and recapturing migratory species inside the Guánica Forest every year for 36 years. This is the longest migratory bird monitoring record in the world, and it is reasonable to expect that an environmental analysis of the impacts of windmills on migratory species would use these data. However, it appears that the many scientific publications documenting the importance of migratory species to the ecology of the Guánica Forest were not accessed by the writers of the DEIS (see a partial list in enclosure 1 of our testimony at the public hearing). Therefore, the DEIS downplays the presence of migratory species in Guánica Forest. In addition to our studies in the Guánica Forest, there is an extensive scientific literature showing that Puerto Rico is an important stop-over for migratory species from North America and that these birds fly at heights that place them in harms way in relation to the proposed wind mills (see references in **enclosure 1**). The data show that migratory species found in Guánica Forest are known to suffer mortality from fly obstacles such as towers and tall buildings.

We cannot, nor should we comment on why the US Fish and Wildlife Service and the Puerto Rico Department of Natural Resources and the Environment proceeded as they did. However, we do mention these studies because they are relevant to the decision-making process of the Planning Board.

3. The recalled enclosure 2 of our testimony was written by Dr. Sandra Molina (professor Catholic University, Ponce) and the material in that appendix is correct and based on research that produced peer reviewed published scientific articles (Molina and Lugo 2006). I am a co-author on this and other papers relevant to dry forests. **Enclosure 2** contains a bibliography of my scientific articles on subtropical dry forests that can be made available to your experts. I will briefly explain some of the misconceptions in the DEIS using literature references from research conducted by the Forest Service in the Guánica Forest.

Misconception: That stem sprouts are only caused by anthropogenic disturbances.

Where? Page 44 of DEIS.

Fact: Many species in the Guánica Forest stem sprout naturally and in response to hurricanes (Molina Colón 1998, Dunphy et al. 2000, Van Bloem et al. 2003 and 2007).

Misconception: That Punta Ventana was historically deforested and degraded.

Where? Page 44 to 45 of DEIS.

Fact: Remote sensing studies show that the Punta Ventana area was closed-canopy forest in the 1936 air photos and continuously since then to the present (Lugo et al. 1996 with maps by Linda L. Vélez Rodríguez). Research plots of Dr. Skip Van Bloem, professor at the University of Puerto Rico, Mayagüez, document mature forest vegetation at the boundary between the Guánica Forest and the site where wind turbines would be located (Van Bloem 2004). Portions of this mature forest was recently cutover to expand forest trails into wider roads.

Misconception: The small diameter of trees at the site is an indicator of forest degradation.

Where? Page 44 of DEIS.

Fact: The subtropical dry forest vegetation is characterized by low diameter vegetation. This is amply demonstrated in the numerous quantitative diameter distribution studies in Guánica Forest (Lugo et al. 1978; Murphy and Lugo 1986 a and b, 1995; Murphy et al. 1995). Only a small proportion of trees reach large diameters. When moisture or temperature conditions change, as happens when one moves from one life zone to another, tree size and vegetation complexity also changes (Lugo et al. 2000). We compared dry forests across the Caribbean (Lugo et al. 2000, 2006; Murphy and Lugo 1986b, 1995) and demonstrated the variation in structure and composition of Caribbean dry forests, which reflect, life zone conditions (*sensu* Holdridge 1967), phytogeographical units (*sensu* Borhidi 1991), and geological substrates (see Lugo et al. 2000). Analysis of available data demonstrates that among Neotropical dry forests, Guánica Forest is one of the driest (Murphy and Lugo 1986b, 1995). In Cuba, five of the six main areas of dry forests receive more rainfall than Guánica (southern coast of Oriente is the exception) and are subjected to different climate (Borhidi 1993). The generalizations in the DEIS cannot be sustained when subject to scientific analysis. The data show that Guánica Forest is unique, particularly as a subtropical dry forest *sensu* Ewel and Whitmore 1973; more on this later.

Misconception: That when the species/area curve saturates quickly at a particular location, it means that the regional flora is impoverished and requires restoration.

Where? Page 45 of DEIS.

Fact: To reach such a conclusion you require many species/area curves scattered over the landscape, certainly more than the one presented in Appendix B of the DEIS. Our studies show that in Puerto Rico, species/area curves are steep and saturate quickly (Lugo 2005), but when replicated in the dry forest, the species components change (Molina Colón et al. in press). In other words, the spatial diversity is large in spite of the small area required for saturation of the species/area curve. To extrapolate this misconception to a statement of need for a restoration is a mistake.

Not understanding the ecological meaning of a species/area curve also leads to the wrong conclusion regarding the species richness of the site. In Appendix B of the DEIS, the consultant expresses his surprise at how low the floristic diversity at the proposed site is, lower than expected and clearly impoverished in relation to the Guánica Forest next door. Yet he encountered 168 plant species in less than 290 hectares (listed under the heading: *List of vascular plants at the Windmar site*). If you divide the number of species by the area sampled (the slope of the species/area curve) you arrive at 0.58 species/ha (168 species/290 hectares) for your property. Do the same calculation for the Guánica Forest (700 species in 4,000 ha) and you get

0.18 species per hectare. Your site has 3.2 times more plant species per unit area than the Guánica Forest, or the opposite of what the DEIS concludes.

As a group, the above misconceptions, reflect gross misunderstanding of subtropical dry forest ecology and leads the DEIS to the wrong conclusions relative to the ecology and ecological history of the dry forests of the site. The misconceptions can be verified by referring to the literature on dry forests listed in **enclosure 2** and in the Literature Cited section of this letter.

4. You state that the dwarf forest that we mention in our statement “is not a recognized or scientifically accepted unique forest type.” Please refer to the book edited by Dr. Rafael L. Joglar of the University of Puerto Rico at Río Piedras (*Biodiversidad de Puerto Rico* [The Biodiversity of Puerto Rico]). There you will find a chapter on the forests of Puerto Rico that I wrote (Lugo 2005). This chapter contains a comprehensive description of Puerto Rico’s dry forests, including the dwarf forest. I co-authored the first quantitative study of the vegetation of the Guánica Forest (Lugo et al. 1978), and in that article, we classified dwarf forest vegetation as scrub forest vegetation i.e., sparse, dwarfed, or malformed vegetation *sensu* Vestal (1944), recognizing that the change in vegetation physiognomy was due to edaphic factors. Later, in our review of the vegetation of the Caribbean (Lugo et al. 2000), we elaborated on these arguments, and upon further observations, we realized that a portion of the scrub forest was dwarf forest with unique ecophysiological responses to environmental conditions. Lugo et al. 2006 provides details on the ecophysiological challenge to plants of this environment.

The dwarf forest type is now the subject of intensive research by the Forest Service, the University of Puerto Rico (Río Piedras), Catholic University (Ponce), and the Venezuelan Institute of Scientific Investigations. We are documenting the structure, functioning, and age of these dwarf forest stands. We find no evidence of cutting or significant human impacts on these forests. By the size of the trees and the slow rate of growth, we estimate these forests to be among the oldest forests in Puerto Rico. We are confirming our estimates with isotope dating. Soon these results will be published in the peer-reviewed literature, but until the science process is completed, it is critical to alert government agencies of the importance of this forest type.

The Puerto Rico GAP program that we mentioned in our statement at the public hearing has mapped the dwarf forest in Guánica Forest (Gould et al. 2007). This map will soon be on the WEB available to the public. However, the map has been available to the Department of Natural Resources and the Environment with whom we worked collaboratively to develop the map. We recommend to extend the map of the dwarf forest to Punta Ventana, and overlay it on Figure 2 (p 9) in the DEIS to find out how much dwarf forest is lost due to the location of wind turbines and ancillary facilities at Punta Ventana.

5. It is a known scientific fact that ecosystems provide services to people. The Millennium Ecosystem Assessment (2005) lists the categories of ecosystems services that humans derive from forests and other types of ecosystems, and which contribute to human wellbeing. Among the ecological values of Guánica Forest is its support for tourism, research, conservation of biodiversity, recreation, education, etc. These ecological services or values contribute to the public good and quality of life and need consideration in any environmental assessment.

6. You have raised questions about the Forest Service Policy regarding wind energy. I responded in my June 29, 2007 letter to the Planning Board with copy to you that the agency was working on a policy, which we would share with you as soon as it was developed. However, on July 11, 2006 our Associate Chief testified in Congress regarding *Renewable Energy on Federal Lands*, a testimony that I share with you as **enclosure 3**. You will see that the Forest Service is not against the location of wind energy facilities on forestlands and that we are taking a proactive approach to the siting of facilities. On page 4 of the testimony, you can read about our concern for migratory species and the two-tier process to evaluate if a site is suitable or not for locating wind energy facilities. In short, our scientific approach begins with an analysis of suitability of sites at regional and local levels before we consider specific proposals for particular locations. This model should be considered for Puerto Rico to avoid unnecessary conflicts or subjecting valuable forests to conflicting uses.

Our ten-point testimony to the Planning Board public hearing at Guayanilla is in agreement with the Congressional testimony of the Forest Service. The Forest Service supports alternative energy sources to reduce the nation's dependency on fossil fuels, but it believes that appropriate and credible environmental analysis should precede decisions regarding the siting of these facilities.

Regarding the location of the windmills, the Figure that was recalled was based on UTM XY coordinates on page 9 (Figure 2) of the DEIS and the diameter of the windmill blades given on the main specifications for the wind turbines included with the DEIS. Anyone can reconstruct the Figure we presented in the hearing and reach the same conclusion that several windmills are so close to the Guánica Forest boundary that the blades could gyrate over the public lands, depending on the angle of operation. If the wind turbines were to fall for any reason, they will likely fall on public land.

7. All the information in the paragraph on wind is from the DEIS. To be sure of where the information in this paragraph is found:

- Wind speed of 8 m/s (Table 3.2.3.1 of DEIS [p 38]).
- Turbines work at 40 percent capacity or less during the high wind season and 17 percent or less during the low wind season (Table 3.2.3.1 of DEIS [p 38]).
- A wind requirement of 20 m/s should say "a wind requirement of 12 to 20 m/s" for an output of 1.65 MV (from the specification of the *Vestas* turbines in the specifications included with the DEIS).

The statement that there are other areas of Puerto Rico with higher winds than those at the proposed site is not from the DEIS because the DEIS only reports wind speed for four locations in the island. However, NOAA's *Climatological Data for Puerto Rico and the US Virgin Islands* contains wind data that shows higher wind speeds in the north coast of Puerto Rico compared to the south coast where the project is located. The Renewable Resource Data Center's WEB Page (<http://rredc.nrel.gov/>) contains numerous maps that show the same thing. The US Department of Energy National Renewable Energy Laboratory released a new map for wind power at 50 m altitude in Puerto Rico and the US Virgin Islands. The map also shows other areas of the island with higher wind speeds than Punta Verraco. According to this map, the

wind power classification of your site ranges from poor, to marginal, to fair, and good, depending on which average wind speed in Table 3.2.3.1 of the DEIS (page 38) is used. The top of the scale is excellent.

8. The photo of a turbine on fire that we withdrew from our statement simply draws attention to the possibility of fires during the operation of windmills. During your visit to my office, you challenged me to show any credible documents that would report fires due to the operation of windmills. **Table 2** is based on credible sources. I was particularly attracted to the following quote: "*Fires are not a common occurrence for wind turbines- but when they do strike, they can be very costly...Fire damage account for between 9% and 20% of wind power insurance claims.*" (N. Smith and E. de Vries 2004, p 1).

The quote above and the information from insurance companies is sobering because even if the chances of a fire occurring at your site was minuscule, say once in 50 years, its effects on the Guánica Forest would be devastating. Our testimony simply raises the possibility of fire and calls attention to the consequences, so that they can be considered and mitigated. The DEIS does not consider this possibility and is based on the wrong premise that the Guánica Forest is subject to natural fires (section 2.3 titled *El factor fuego* in appendix B, vegetation study). This is incorrect. The Guánica Forest has no adaptation to fire because it has no history of natural fires. Therefore, any fire induced by this proposal could have devastating effects on the forest, particularly with the direction and speed of the wind at the site. Given the close proximity of the 40-m tall wind turbines to the public lands, it is unrealistic to expect the 5 to 10 m-wide roads to act as fire brakes. Our statement is not, as you claim, an exaggeration. We present a credible scenario that requires attention if the ecological values of the Guánica Forest are to be conserved.

9. The carbon sink of the dry forest is about 10 Mg/ha.yr (Lugo et al. 1978). The point is not to deny the importance of windmills as carbon offsets, but to remind the Planning Board that forests also sequester carbon and provide atmospheric cleansing services.

10. Our statement about the importance of the Guánica Forest is based on Ewel and Whitmore (1973). The actual quote and context is (p 20): "*The Guánica Forest, which has been protected from charcoal cutting, goat grazing, and subsistence farming for more than 40 years, is perhaps the best example of subtropical vegetation in subtropical Dry Forest anywhere in the world.*" We shortchanged the forest by limiting the comparison to the Caribbean. To understand this remark, and to correctly compare Guánica Forest with other dry forests, one must understand the meaning of the life zone concept of Holdridge (1967), on which the work of Ewel and Whitmore (both Forest Service scientists at the time, as was Holdridge) is based.

Regarding the buffer zone around Guánica Forest, our proposal to the Planning Board is that they treat Guánica Forest as they do the El Yunque National Forest. Such buffer zones do not involve taking of lands as discussed in Lugo et al. (2004). Both the Puerto Rico and United States of America Supreme Courts have so stated. Excerpts of court decisions are quoted in Lugo et al. (2004; their Table 4 on pages 15-16).

We trust this letter gives you a better understanding of the scientific basis of our statement to the Planning Board. For your information, **enclosure 4** is my curriculum vita and **enclosure 2** is a

list of my publications on dry forests, so that you understand my credentials and the source of my knowledge about Guánica Forest. We believe that by disclosing all the available and relevant information for analyzing your proposal to the people of Puerto Rico, the Commonwealth government will be in a better position to reach an enlightened decision that reduces fossil fuel dependence while preserving the ecological values of the Guánica Forest, one of the global-level natural treasures of Puerto Rico.

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Sincerely,



Ariel E. Lugo
Director

Cc:

A. Bartuska
T. de Coster
JP
EQB
DNRE
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Table 1. The abundance of migratory birds in capture/recapture studies in the Caribbean islands.

- Dr. John Faaborg (professor at University of Missouri-Colombia), Dr. Wayne Arendt (Forest Service scientist), and colleagues have captured about 30,000 birds from around the Caribbean from the Bahamas to Aruba and Bonaire. Of those about 10,000 individuals or 33 percent were migrants.
- They have captured about 5,000 birds around Puerto Rico. Of these, about half of the individuals were migrants captured in Guánica Forest (1972-2007).
- Robbins et al. (1987) from the US Fish and Wildlife Service's Patuxent Wildlife Research Center captured 2,475 migratory birds on three Caribbean islands (Jamaica- 1,070; Hispaniola- 487, and Puerto Rico- 918).
- 1,114 of the 2,476 migrants (almost half) that Robbins et al. captured in the three Caribbean islands were passerines, i.e., Guánica Forest migratory species

Reference:

Robbins, C.S., B.A. Dowell, and D.K. Dawson. 1987. Comparison of Neotropical winter bird populations in isolated patches versus extensive forest. *Acta OEcologica. Generalis*. 8: 285-29.

Table 2. Some information sources with evidence for the occurrence of fires during the construction and operation of wind turbines and ancillary facilities.

- Smith, N., and E. de Vries. 2004. Wind and fire. Reducing the risk of fire damage in wind turbines. *Renewable Energy World* **September-October**:1-4.
 - http://www.osha.gov/pls/imis/accidentsearch.accident_detail?id=2... Report of a fire accident (number 201485257) in a wind turbine.
 - IMIA insurance of wind turbines. Report by C. Jakobsen, H. Reymann-Carlsen, J. Boogaard, A. Martin Martin and N. Kragelund, B. Balschmidt of the Danish Insurance Association. IMIA-WGP5(99)E. This is a report of 15-years of experiences with accidents and the insurance of wind turbines in Denmark. Fire and lightning are important sources of claims and payments.
 - Draft EIR, County of Contra Costa Community Development Department. Buena Vista Wind Energy Project (LP#022005). This environmental assessment by a County Government in California, describes the many precautions needed to deal with fire hazards, including ground fires, in a wind energy project.
 - Bushfire risk management plan for Black Springs Wind Farm, west of Sydney, Australia. Prepared by Harper Somers O'Sullivan, Sydney, Australia. This 2006 fire management plan is remarkable not because the fire risk is high (it is not) but because of the precautions that are recommended during construction and operation of the windmills, and the vegetation-free buffer recommended (140 m). The plan underscores the point that fire hazards are to be taken seriously when dealing with windmills.
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Enclosure 1. Some references that highlight the altitude at which migratory birds fly and their vulnerability to collisions.

Satatement: Small passerines (songbirds like warblers) fly at about 55 km / hour and can fly higher than 1,000 m.

Supporting literature:

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Enclosure 2. Scientific articles on dry forests authored or co-authored by Ariel E. Lugo and colleagues. The publications are arranged in chronological order of publication.

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Enclosure 3. *Renewable Energy on Federal Lands*, Congressional testimony of Associate Chief Sally Collins (enclosed as a separate pdf file).

Enclosure 4. Curriculum Vitae of Ariel E. Lugo (enclosed as a separate WORD file).