MAKING WIND POWER MORE BIODIVERSITY-FRIENDLY: RECENT LESSONS FROM WORLD BANK EXPERIENCE

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(The views expressed here are those of the author and should not be attributed to the World Bank Group.)

Main Environmental and Social Impacts of Onshore Wind Power

- **Biodiversity** Impacts--birds, bats, and natural habitats.
- **Local Nuisance** Impacts—visual, noise, interference with radar, telecommunications, aviation, etc.
- **Socio-economic and Cultural** Impacts—land acquisition, local incomes (benefits-sharing), indigenous and traditional communities, physical cultural resources.

Besides wind farms, need to consider **complementary infrastructure**—transmission lines and access roads.

Bird Collisions with Wind Power Equipment

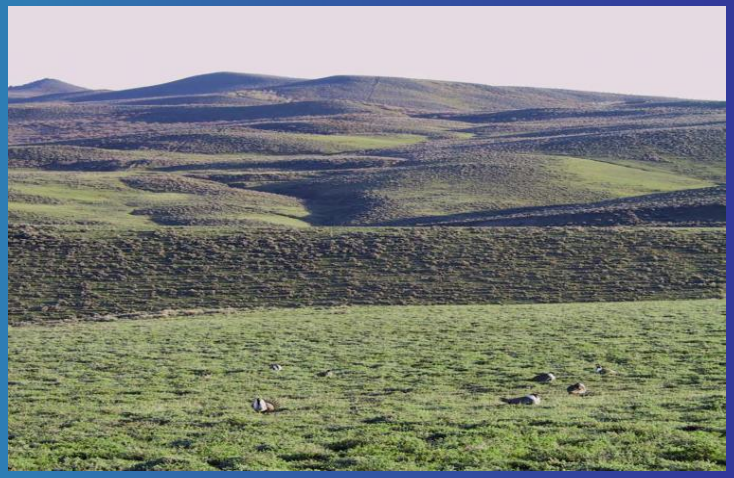
- Mostly with wind turbine rotors; some with turbine towers or masts with guy wires.

- Rotor tip speed is very high (even if low RPM); birds get hit by surprise.

- Some bird species are especially collision-prone, e.g. large soaring birds.

- As an example, watch brief video of Eurasian Griffon Vulture struck by wind turbine in Crete, Greece: http:youtu.be/9srPoOU6_Z4

Other Impacts of Wind Power on Birds



Displacement from otherwise suitable habitat by tall structures and/or human presence:

- **Naturally treeless habitats (natural grasslands, shrub-steppe, etc.).**

- **Affects prairie grouse; perhaps bustards, other birds of conservation concern; also shy wild mammals.**

Impacts of Wind Power on Bats

- Collision problem probably worse for bats than for birds, because many bats appear attracted to moving rotor blades (for unknown reasons).

- Bat fatalities often higher than bird fatalities at well-monitored wind farms.

- Bats have naturally low reproductive rates, so scaled-up wind power in sensitive sites could threaten some species.

Impacts of Wind Power on Natural Habitats

- **Land Clearing** (~1-2 ha/MW) for turbine platforms, access roads, construction staging areas, etc.

- **Habitat Fragmentation** from rows of turbines and connecting roads.

- **Special Cases:**
  - Land degradation from careless **off-road driving**.
  - Specialized, endemic **ridge-top vegetation** may be disproportionately affected (especially in tropics).
  - **Downwind sand dunes** might be altered.

Biodiversity Impacts of Ancillary Facilities: Transmission Lines

- **Bird Collisions** (large-bodied, fast-flying species)
  - Serious threat to some species, e.g. Ludwig's Bustard (Karoo plains of South Africa, Namibia)
  - Wetland sites (bird concentrations)
  - Mitigated through careful alignment; use of BFDs
- **Bird Electrocutions** (especially raptors)
  - Bird-friendly power pole and wire configurations
  - U.S. Avian Power Line Interaction Committee (APLIC) useful source <www.aplic.org>
- **Bird Perching and Nesting** (mostly benign)
- **Forest Fragmentation**

Biodiversity Impacts of Ancillary Facilities: Access Roads

Induced Impacts (from increased human access):

- Deforestation or other land clearing
- Excessive wood cutting
- Hunting of vulnerable species

Direct Impacts (from civil works):

- Direct loss of natural habitats (ROW, etc.)
- Fragmentation of natural habitats
- Altered drainage patterns
- Pollution or sedimentation of aquatic ecosystems
- Disturbance from construction workers
- Wildlife road kills

Applicable World Bank Safeguard Policies

- Environmental Assessment OP 4.01: All projects.
- Natural Habitats OP 4.04: Natural land and water areas (including biologically active airspace).
- Forests OP 4.36: Natural and Plantation Forests
- Involuntary Resettlement OP 4.12: Compulsory land acquisition.
- Indigenous Peoples OP 4.10: Vulnerable ethnic minorities (traditional rural populations).
- Physical Cultural Resources OP 4.11: Archaeological, historical, sacred sites or objects.

Applicable IFC Performance Standards

- **PS 1: Social and Environmental Assessment and Management System**
- **PS 2: Labor**
- **PS 4: Community Health and Safety**
- **PS 5: Land Acquisition and Involuntary Resettlement**
- **PS 6: Biodiversity Conservation and Sustainable Natural Resource Management**
- **PS 7: Indigenous Peoples**
- **PS 8: Cultural Heritage**

WBG Official Guidelines:

Environmental, Health, and Safety (EHS) Guidelines for Wind Energy
(World Bank Group, 2007)

- **Overview of most environmental impacts (also occupational health and safety)**
- **Limited discussion of bird and bat issues**
- **Downloadable from:**

http://www1.ifc.org/wps/wcm/connect/3af2a20048855acf8724d76a6515bb18/Final%2B-%2BWind%2BEnergy.pdf?MOD=AJPERES&id=1323162509197

Technical Guidance (WB Study):

Greening the Wind: Environmental and Social Considerations for Wind Power Development (Ledec, Rapp and Aiello, 2011)

World Bank book (ISBN 978-0-8213-8926-3): Available from WB InfoShop or on-line <www.amazon.com>

- **Full Conference Report (content same as WB book): <www.tinyurl.com/GreeningTheWind>**
- **Synthesis Report (concise summary): <www.tinyurl.com/GreeningTheWind2>**
- **In-depth coverage of biodiversity issues (birds, bats, and natural habitats)**
- **All volumes include handy Table of Environmental and Social Impacts and Corresponding Mitigation or Enhancement Options**

MEXICO La Venta II Wind Power Project (85 MW, 98 turbines)

- Demonstrated technical and financial feasibility of **short-term shutdowns**, on-demand & in real time
- World-class migratory bird corridor, yet more fatalities among **resident birds**
- More **bats** killed than birds
- Surprising number of low-flying birds collide with **turbine towers** (not rotors)

- Entire wind resource area has **biologically unique** thorn forest habitat (largely overlooked, no legal protection)

URUGUAY Wind Farm Project (10MW, 5 turbines)

- Project area (Sierra de Caracoles) assessed to be low risk for birds, uncertain risk for bats.

- Since bats fly mainly during low winds, higher turbine cut-in speeds can greatly reduce bat mortality, often with little loss in power generation.

- Under agreed Bird and Bat Monitoring Plan (BBMP):
  - Year 1: Operate turbines at normal 4 m/s (day & night).
  - Year 2: If monitoring find >5 dead bats/MW, operate at 6 m/s (night).
  - Year 3: If monitoring shows significant drop in bat fatalities, continue operating at 6 m/s (night).

- Emissions Reduction Purchase Agreement makes BBMP--with this operating condition--legally binding.

Challenges to making Wind Power more Biodiversity-Friendly

- "Clean & Green Energy" image:
  - Low-carbon does NOT mean low overall environmental impacts.
- Steep learning curve about biodiversity impacts and how best to mitigate them.
- Incentive frameworks needed to promote wind power that is also biodiversity-friendly:
  - Financing requirements (CIF, WBG, other MDBs, bilaterals, Equator banks, etc.)
  - Environmental laws and regulations (national, local)
  - Government energy policies (renewable mandates, feed-in tariffs, power grid integration, etc.)
  - Stakeholder pressures (NGOs, local residents)

Key Tools to make Wind Power more Biodiversity-Friendly

- **Planning:**
  - **Site selection** (ideally, low bird & bat numbers; no species/ecosystems of conservation concern)
  - More bird-friendly **equipment**: Turbines, lighting, masts, transmission lines, power poles
  - **Strategic EAs**: Overlay maps & zoning maps
  - **Project-specific EIAs**, including wind farm EMPs
  - **Bidding documents & contracts** with environmental requirements for construction/operation
  - **Conservation offsets**: Off-site species/habitat enhancements
- **Construction:**
  - **Environmental rules for contractors**
  - Diligent **field supervision**
- **Operation:**
  - **Post-construction monitoring** of bird/bat fatalities
  - **Operational curtailment:**
    - **Increased cut-in speed** (bats)
    - **Short-term shutdowns** (migratory birds)