भारतीय वन्यजीव संस्थान
Wildlife Institute of India

POWER-LINE MITIGATION

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TO CONSERVE BUSTARDS

Graphic created to depict the situation by Devesh Gadhavi

EVIDENCE OF IMPACT

a) Bustards are prone to collision.

Bustards have wide sideways vision to maximize predator detection, at the cost of narrow frontal vision. Because of this, and a habit of scanning the ground while flying, they cannot detect power-lines ahead of them, from far. Being heavy fliers, they fail to manoeuvre across power lines within close distances. The combination of these traits make them vulnerable to collision with power-lines. As a result, they collide with power lines and die from the impact, injuries/trauma or electrocution (Martin and Shaw 2010).

b) Evidence of bustard mortality due to power lines.

Worldwide, studies have shown high mortality rates of several bustard species because of power-line collision. For example, 30% of Denham's bustards (Neotis denhami) die annually from power-line collisions in South Africa (Shaw 2009, Jenkins et al. 2010). In Spain, 8.5 km stretch of power-line killed a minimum of 25 Great Bustards in one year (JC Alonso pers. obs.). A review (Mahood *et al* 2017/18) of nine studies covering six bustard species from different parts of the world estimated 7 detected bustard mortalities per 10 km power-line per year. This factor causes 4 - 7% mortality of Great Bustard in areas with low power line density (Martin 2008) and 13% mortality in areas with high power line density (Alonso 2007).

c) Evidence of Great Indian Bustard (GIB) collisions with power lines in India

Surveys conducted by Wildlife Institute of India (WII) in Thar covering 80 km of power lines repeated 7 times over a year found 289 carcasses of around 30 species including the Great Indian Bustard (GIB). **The study detected 8 carcass/10 km for high tension and 6 carcass/10 km for low tension power-lines**. Correcting these mortalities for the proportion of carcasses that are decomposed before survey or are missed during survey, mortality rate was estimated to be ~5 bird/km/month and ~1 lakh bird per/year within 4200 sq. km area. In terms of GIB, 4 mortality were recorded (2 during and 2 outside of surveys), all due to high tension transmission lines - some of them connected to wind turbines. Extrapolating these mortalities to the priority bustard habitat, intersected by ~150 km high tension lines, about **18 GIB likely die per year** from a population of about 128 ± 19 individuals in Thar. **Such high mortality rate (at least 15% annually due to power lines alone) is unsustainable for the species.** WII also tagged five Great Indian Bustard on pilot basis in Gujarat and Maharashtra, out of which two died from power line collision, corroborating the earlier findings. One of these dead birds was ranging across hostile infrastructure between Naliya and the western costal grassland of Abdasa tehsil, where it collided with a 33kv power-line connected to Suzlon wind turbine near Lala Bustard Sanctuary.

d) Impact of power line collision on bustard population.

Bustards are long-lived birds where adults have high annual survival probability (Palacín *et al* 2012) in original habitat. The excessive mortality due to power-lines are unsustainable to their populations and can cause population declines and even extinction (Martin 2007). Power-line mortality can also disrupt important biological processes. Palacín et al (2012) shows that in a Great Bustard population in Spain, where migratory individuals suffered significant power-line mortality, the proportion of sedentary individuals increased over years against the reduction of migratory individuals. Here, power lines have reduced the propensity of a species to migrate, and can result in the loss of such intricate behaviours.

e) Mitigation of threat.

Mitigation measures are available to reduce power-line mortality, such as under-grounding of cables and fitting overhead wires with bird diverters. Bird mortality and crossing rate through wires reduce, if lines are marked with diverters compared to unmitigated segments. Studies examining the effectiveness of these mitigation measures have shown that **collision rate of birds reduces in marked or under-grounded line compared to unmitigated lines** (Alonso *et al* 1994). While under-grounding of cables eliminates bird mortality, marking power line can reduce mortality by 10 % (Barrientos *et al* 2012) to 78 % (Barrientos *et al* 2011), depending on area and species, but not eliminate mortality.

G.S. BHARADWAJ

IMPORTANCE OF TELEMETRY IN POWER-LINE MITIGATION

Great Indian Bustard ranges over large human-dominated landscapes that are facing rapid expansion of power-lines. Curtailing all infrastructural development across these large areas is impracticable and calls for prioritization of areas where these infrastructure should be avoided or mitigated. Advanced telemetry approach can aide in this process, by generating fine-scale information on the birds' movement patterns that can be overlaid on existing power-line maps to identify segments for mitigation measures. Thus, telemetry supplemented with bird surveys provide a powerful tool to prioritize habitats for infrastructure mitigation in particular, and conservation management in general.

Wildlife Institute of India demonstrated the potential of this tool in GIB conservation, by tagging two juvenile birds in Naliya, Gujarat using solar powered GSM/GPS tags that weighed <1% of the bird's body weight. These tags have provided information on bird movements for >1 year (May 2017 onwards) and have also provided evidence of one bird mortality from collision with 33 kV power-line near Lala Bustard Sanctuary. Movement data obtained from tagged birds was overlaid on habitat and infrastructure maps to identify critical areas for mitigating power-lines (see fig 1). However, individuals vary in their movement patterns and more birds need to be tagged across bustard landscapes (Thar, Rajasthan and Kutch, Gujarat) to draw population-level inferences and achieve best conservation results with finite resources.

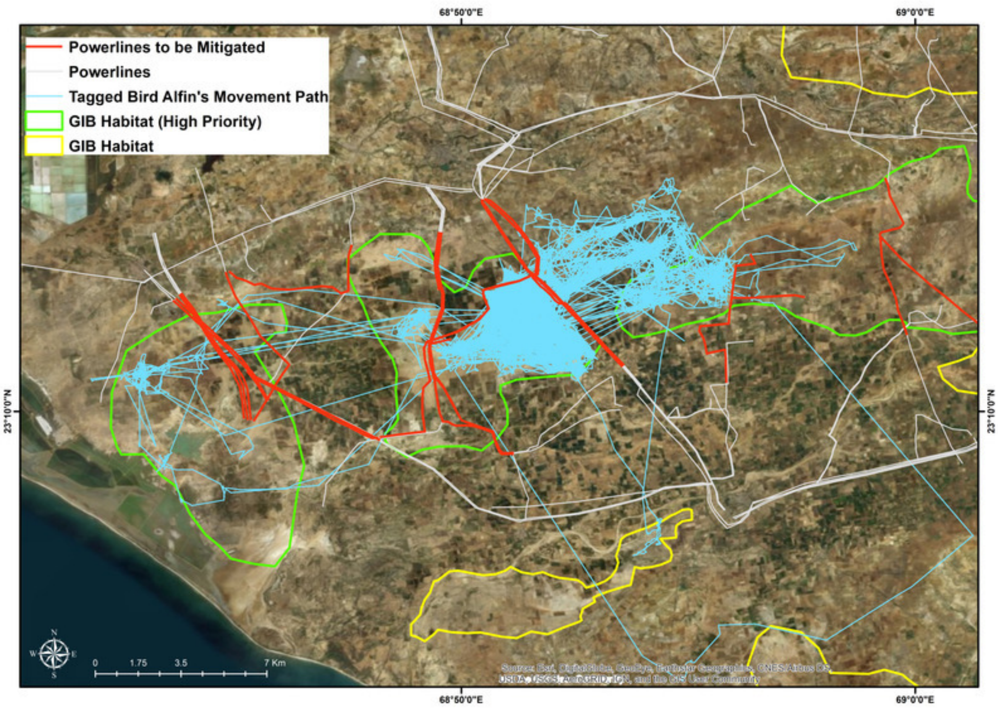
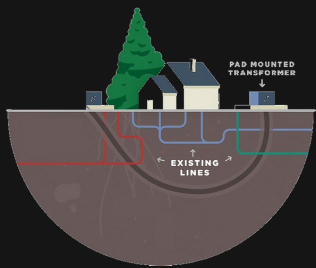


Figure 1 : Movement of tagged Great Indian Bustard overlaid on network of power lines and critical areas for mitigating power-lines (red lines).

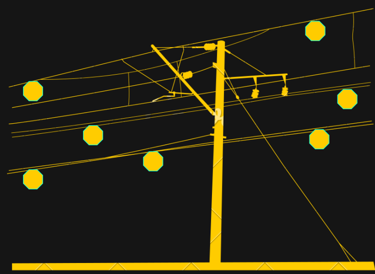
SOLUTIONS

This crisis can be mitigated as follows:

Avoid/divert any new high tension power line from priority Great Indian Bustard habitat that have been mapped by Wildlife Institute of India (Figure 2a & 2b).



Undergrounding of <66kv wires in most risky power-lines in priority GIB habitat (some stretches already mapped, rest is being mapped).



Retrofitting of existing overhead wires with bird diverters (details of diverter makes and costs, and installation design in figure 3).

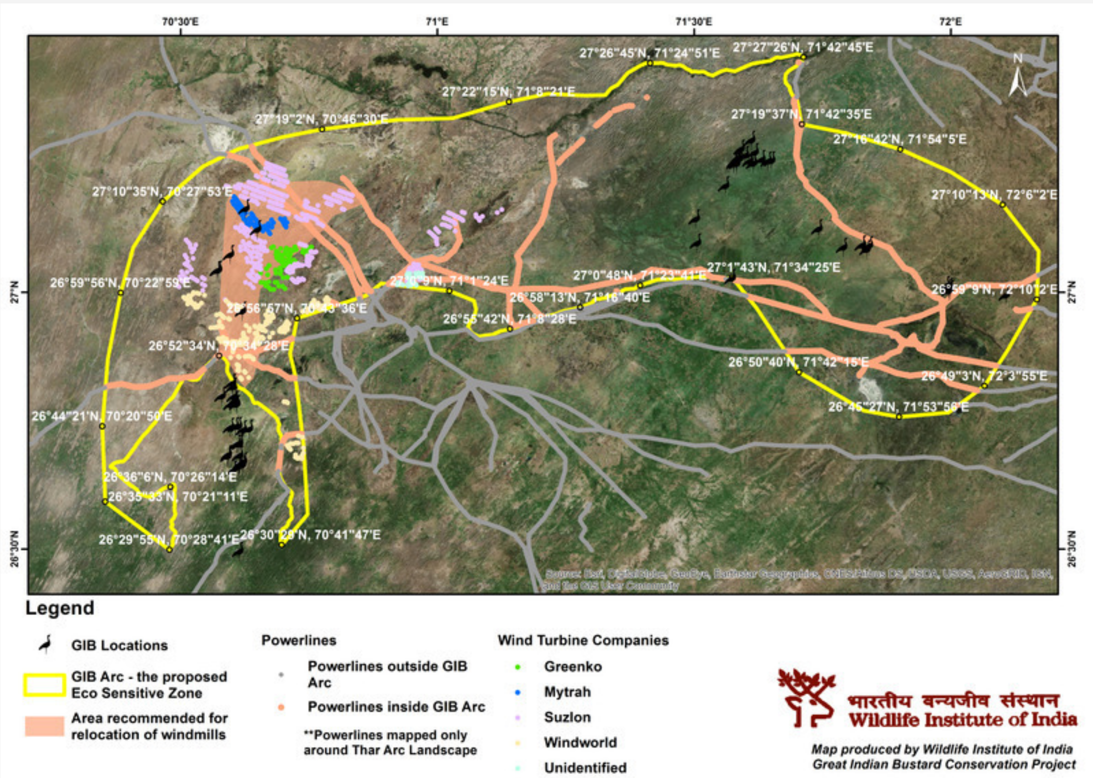


Figure 2a - Map showing proposed Eco sensitive Zone, High-tension power lines and Wind turbines in Thar, Jaisalmer.

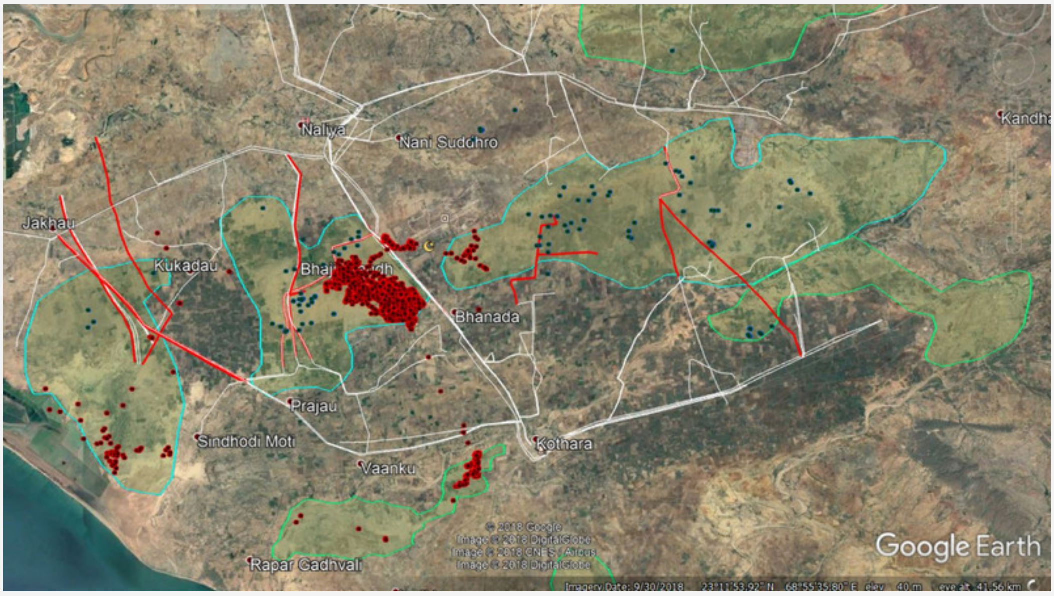
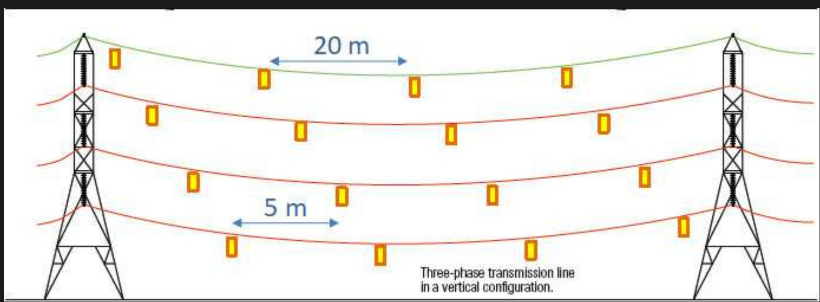
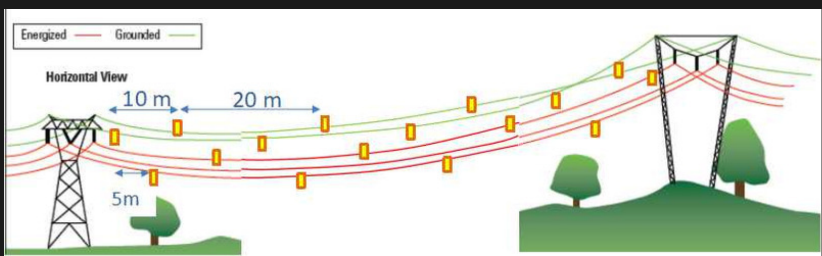


Figure 2b – Map showing Great Indian Bustard habitats in Abdasa, Kutch, with power-lines marked in white (incomplete mapping) and bustard locations as red (telemetry data) and blue (survey locations). Risky power-lines that need to be mitigated urgently have been marked in red lines.

Figure 3 : Details of diverter makes and costs, and installation design





Cost calculations:
Central 60% marking
~ 1 diverter/4m line
~3500 INR/unit (export)
~8.75 lakh INR/km (export)
~2.5 lakh INR / km (local)

Installation

Marking earth wire with 1 diverter at every 10m, and marking other wires with 1 diverter at 15 m in a staggered way, such that conductors as a whole have at least 1 diverter every 5-6 m on a line

Marker	Dimensions	Spacing	Effectiveness	Remarks
Suspended object Fire Fly & Flappers (P&R Tech, USA)	9x15 sqcm	5–15 m	More effective than BFD/SFD	Used in 11–440 kV Min. corona for<115 kV lines
Spirals -Bird &Swan Diverters (PLP, Thailand)	18-60cm & 51-117 cm length	5–20 m 15–30 m	Reduced collisions, by 10 –100%	Used in11–500 kV Min. corona for <230kV lines
Aerial Spheres Span Guard Marker (P&R Tech, USA)	30 cm diameter	30–100 m	Reduced collisions, up to 50%	Suitable for high voltage lines (345 –500 kV)

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