The role of wind turbines in the context of habitat quality – the case of Lapwing (*Vanellus vanellus*), Skylark (*Alauda arvensis*) and Meadow pipit (*Anthus pratensis*) in a cultivated raised bog in northern Germany

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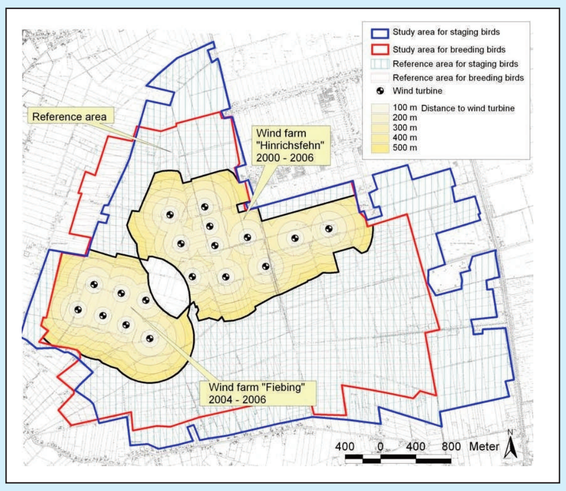
Introduction

Most studies on displacement effects of breeding birds do not take the influence of habitat quality into account. Therefore they mostly assume that the distribution without wind turbines is more or less uniform. In this way however, it is not possible to separate the effects of wind turbines from the influence of other parameters. In a two year study we compared nest sites and territories of Lapwing, Meadow pipit and Skylark between two wind farms (one in construction during study time) and a reference site only in areas with the same habitat quality based on multiple logistic regression models.

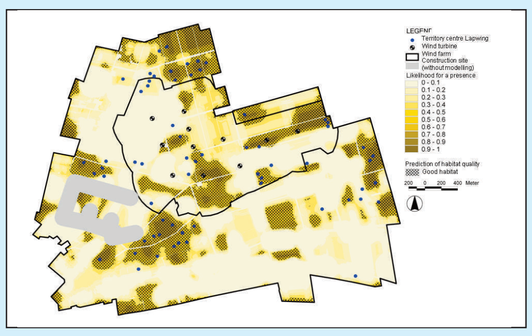


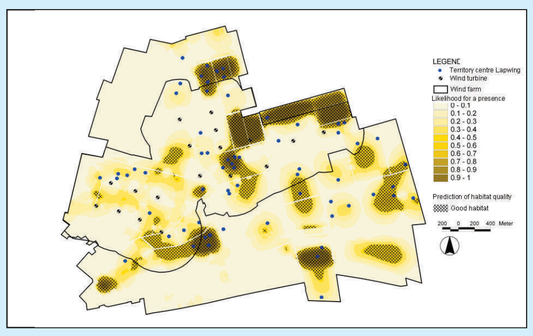
RESULTS

Lapwing (*Vanellus vanellus*)

- Good habitat 2003: Low unstructured vegetation, no wood, no brown vegetation (rush, Juncus spec.), no intensively used grassland
  Good habitat 2006: Open area with corn and/or recently sowed grassland
- Both good and poor habitat were used, but displacement from good to poor habitat or from the windfarms into the reference area because of turbine proximity could not be detected.
- Territory density in good habitat was higher in the wind farms than in the reference area in both years.
- BACI-comparison (Before-After-Control-Impact) for the wind farm Fiebing showed decreasing overall density inside the wind farm but increasing density with regard to good habitat.

	area [ha]	Territories per 10 ha 2003	Territories per 10 ha 2006	Territories per ha good habitat 2003	Territories per ha good habitat 2006
Reference area	629	0.48	0.45	0.24	0.31
Wind farm Hinrichsfehn	296	0.71	0.84	0.32	0.50
Wind farm Fiebing (2003 without wind turbines)	193	1.13	0.57	0.34	0.64





Discussion

Despite a decreasing density of Lapwing territories after turbine construction in the wind farm Fiebing the density with regard to the good habitat increased inside the wind farm and was higher than in the reference area.
For the Skylark a displacement from the wind farm area (wind farm Hinrichsfehn: 6 years after construction) into the reference area could be determined, although the BACI comparison showed an increasing overall density in the wind farm Fiebing after construction. This is the first time that long term effects of wind turbines were detected for a song bird.
The density of the Meadow Pipit showed a slight decrease in all areas and was on the same level between the wind farms and the reference area in both years.
The BACI-design and the incorporation of habitat quality did not show a negative impact of the wind farms for Lapwing and Meadow Pipit. Only a small scale displacement (100 m) was revealed by an impact gradient analysis (comp. Reichenbach & Steinborn oral presentation, session 5 of this conference).

Methods

The study area was located in north-western Germany. The territories were mapped during 10 excursions per year (2003 and 2006). In total 114 habitat parameters were sampled:

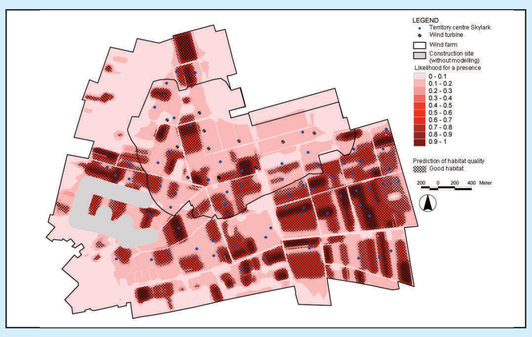
- Vegetation and structure parameters
- Land use
- Kind of biotope
- Ground colour
- Distance from houses and number of houses in a circle of 500 m
- Length of fences, hedges etc.

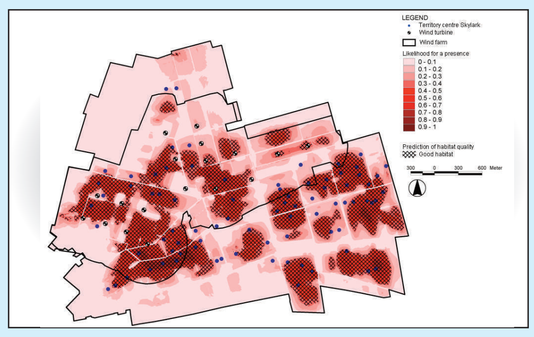
The habitat quality was calculated by using the stepwise multiple logistic regression with presence and absence data of the birds in the reference area (without wind turbines).

Skylark (*Alauda arvensis*)

- Good habitat 2003 and 2006: Open area with extensively used grassland, patchy vegetation with heights up to of 10-20cm and no houses in an circle of 500 m.
- No displacement from good to poor habitat because of turbine proximity detectable.
- Territory density in good habitat:
  2003: Higher density in the wind farm than in the reference area
  2006: Lower density in the wind farm than in the reference area
- BACI-comparison for the wind farm Fiebing showed an increasing overall density inside the wind farm but decreasing density with regard to good habitat.

	area [ha]	Territories per 10 ha 2003	Territories per 10 ha 2006	Territories per ha good habitat 2003	Territories per ha good habitat 2006
Reference area	629	0.62	0.75	0.17	0.35
Wind farm Hinrichsfehn	296	0.78	0.57	0.35	0.21
Wind farm Fiebing (2003 without wind turbines)	193	0.99	1.09	0.27	0.21





Meadow Pipit (*Anthus pratensis*)

- Good habitat 2003 and 2006: open area, with no houses in a circle of 500 m, no black ground colour but a patchy vegetation with heights up to 25 cm.
- No displacement from good to poor habitat because of the turbine proximity detectable.
- Territory density in good habitat:
  Nearly the same in all areas in 2003 and 2006.

	area [ha]	Territories per 10 ha 2003	Territories per 10 ha 2006	Territories per ha good habitat 2003	Territories per ha good habitat 2006
Reference area	629	0.52	0.48	0.25	0.19
Wind farm Hinrichsfehn	296	0.41	0.61	0.26	0.22
Wind farm Fiebing (2003 without wind turbines)	193	0.70	0.62	0.24	0.17