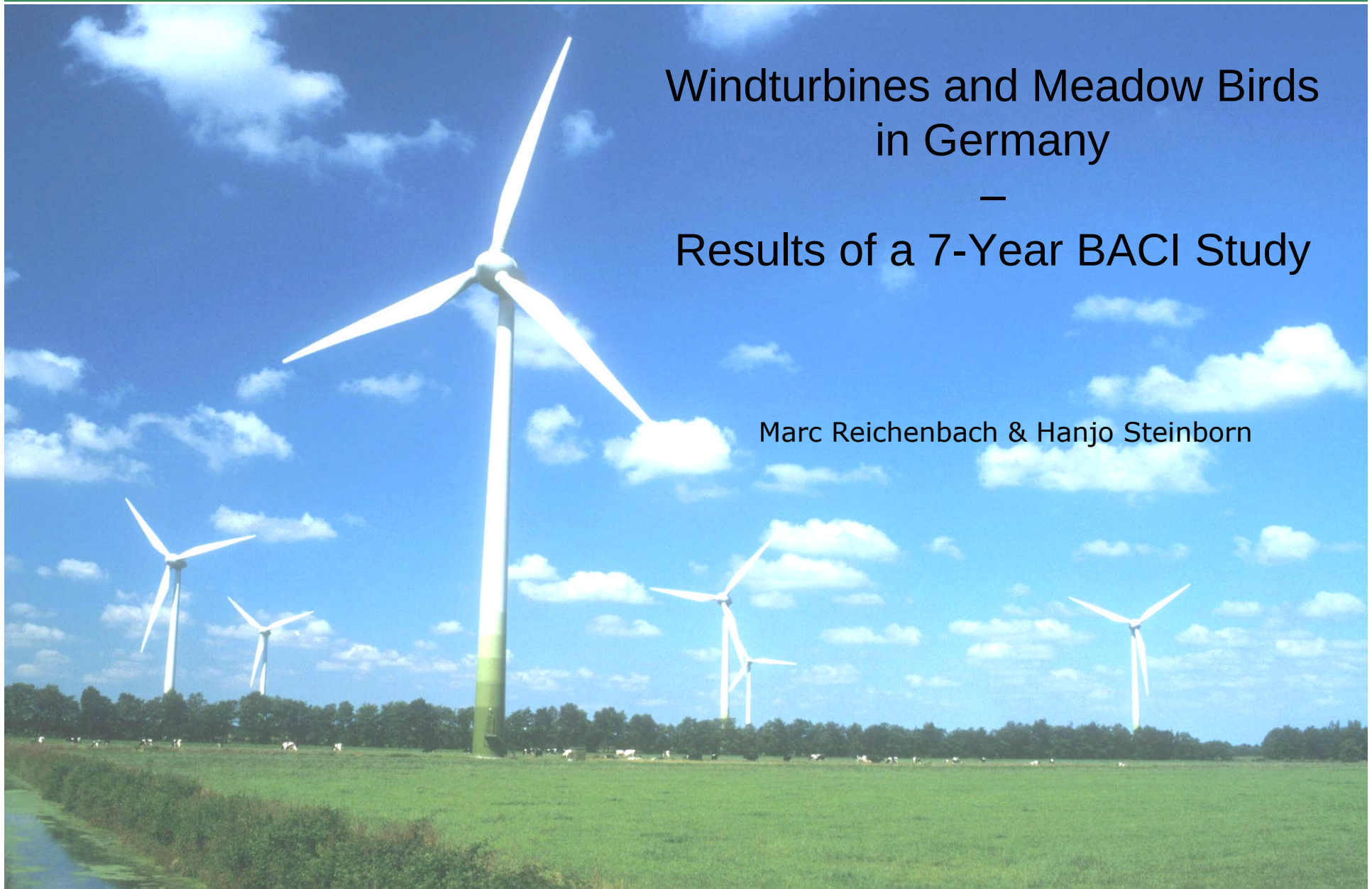


Windturbines and meadow birds in Germany
Results of a 7 year BACI-study and a literature review

Windturbines and Meadow Birds in Germany

— Results of a 7-Year BACI Study

Marc Reichenbach & Hanjo Steinborn



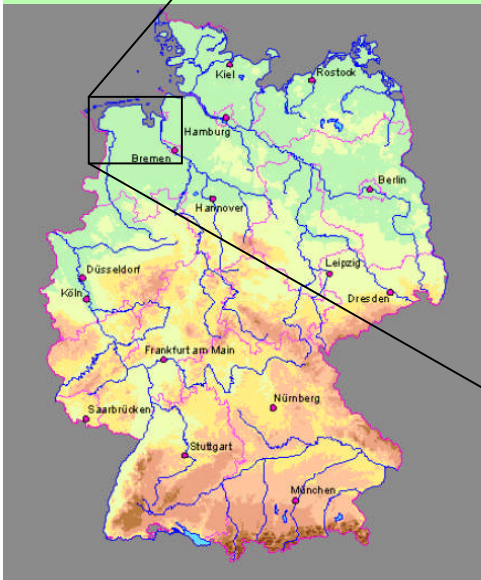
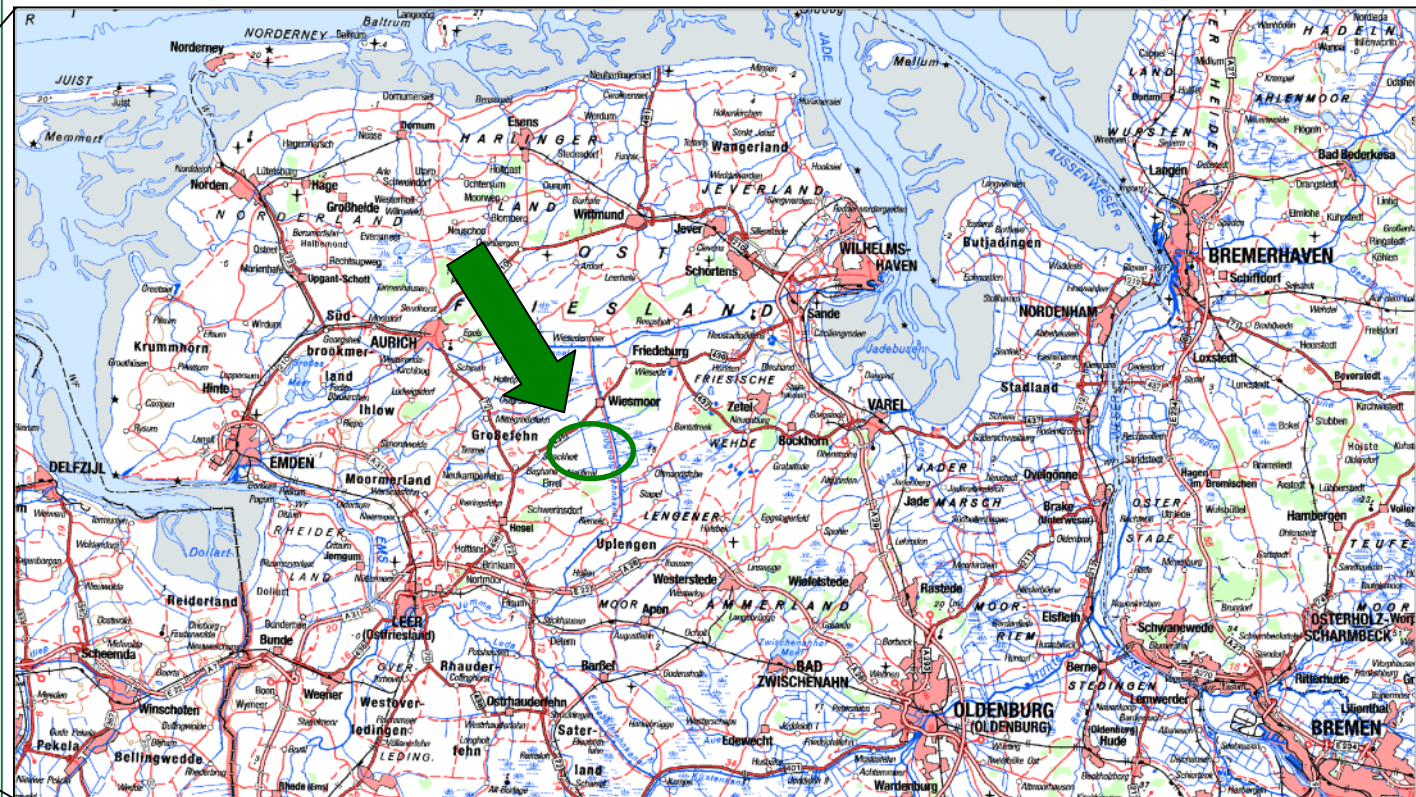
Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Methods

Study area

Location of the study area:

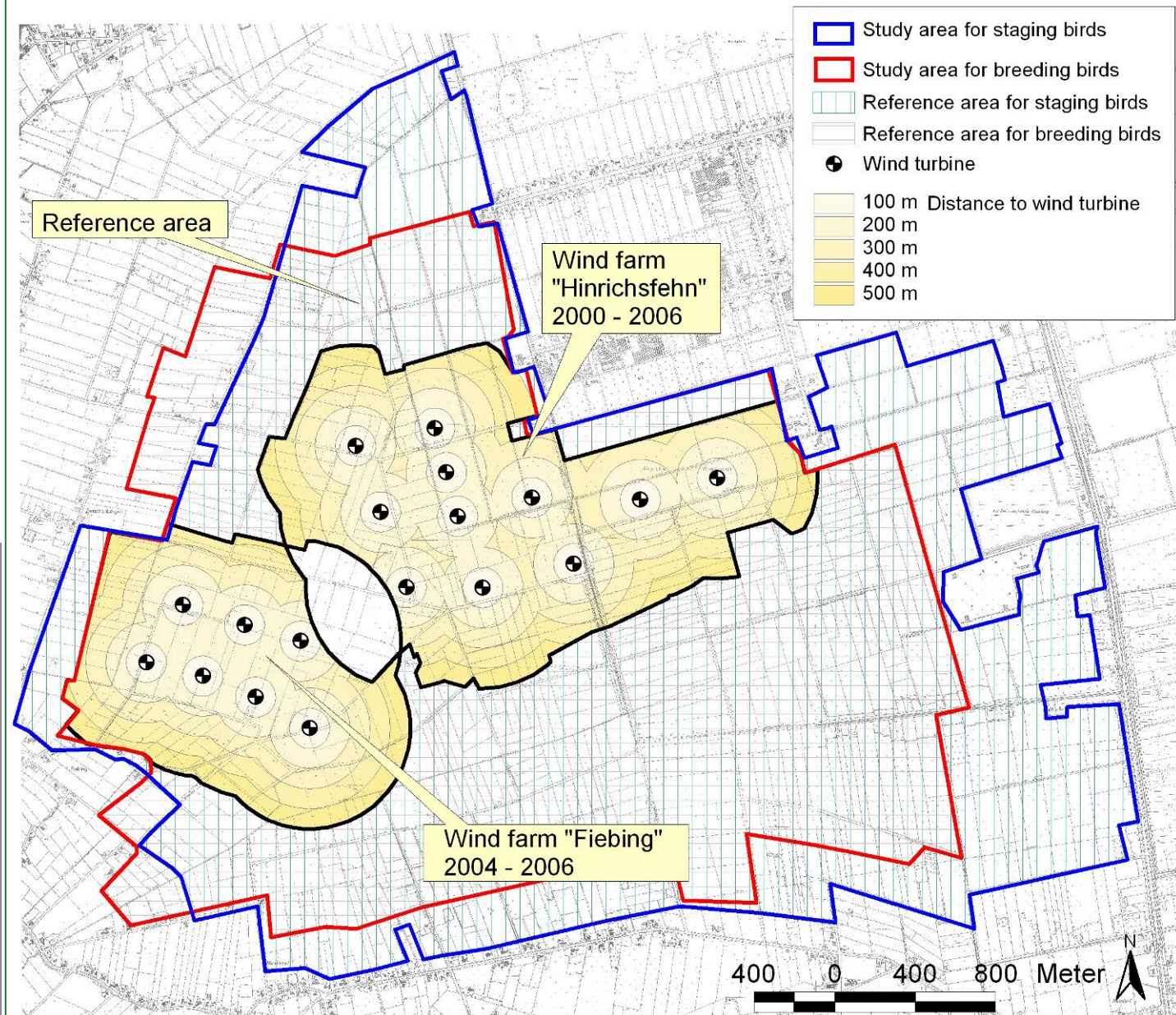
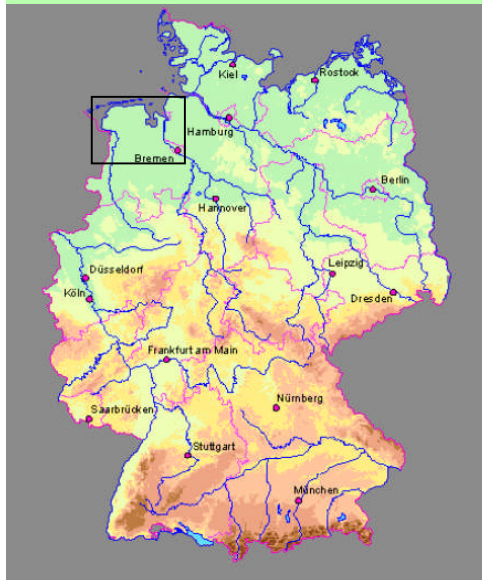


Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Methods

Study area

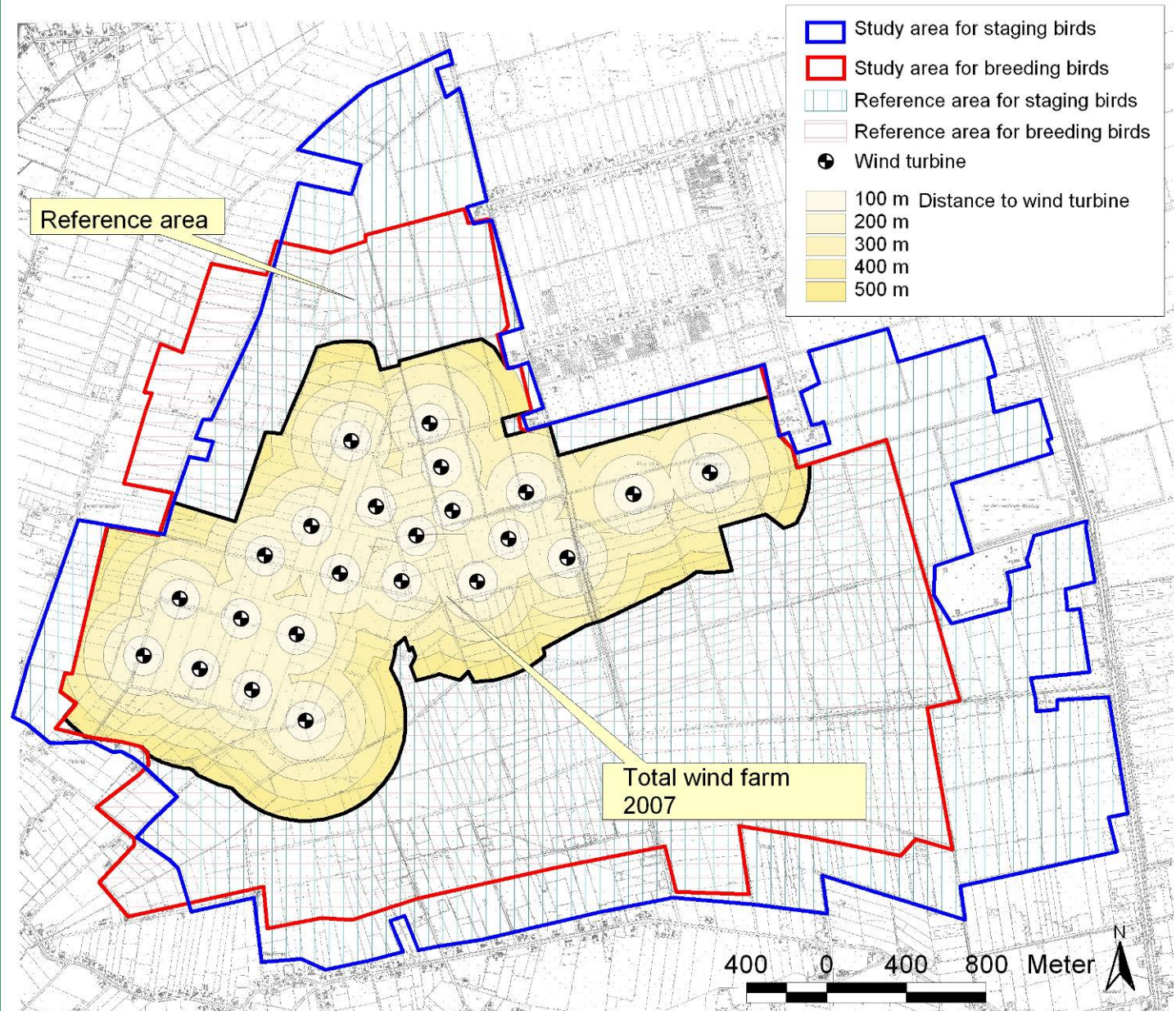
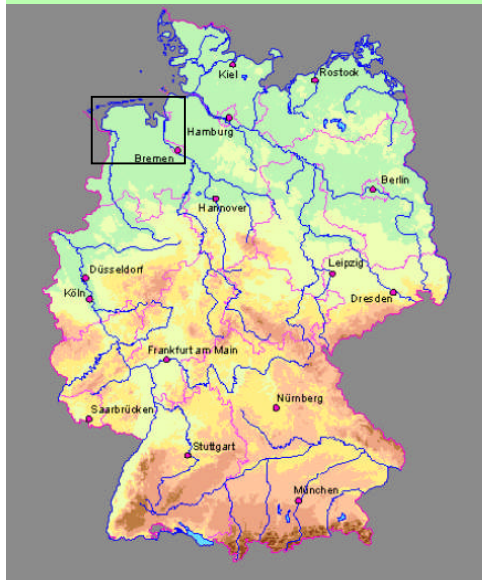


Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Methods

Study area



Windturbines and meadow birds in Germany

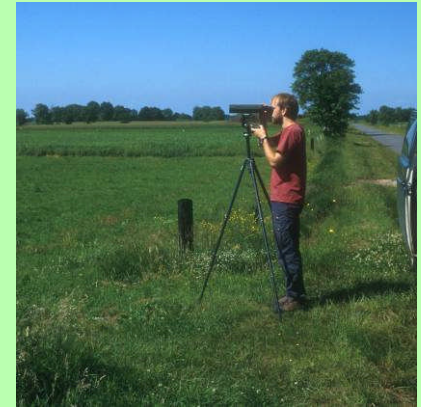
Results of a 7 year BACI-study and a literature review

Methods

Study design

Study design
Sept. 2000 – Dec. 2007:

- Breeding bird survey
(10 excursions per year)
- Control of breeding success
- Staging bird survey
(every 10-14 days,
in total 233 excursions)
- Mapping of land usage
- Habitat modelling 2003/2006
- Behaviour recording (2001-2003)



Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

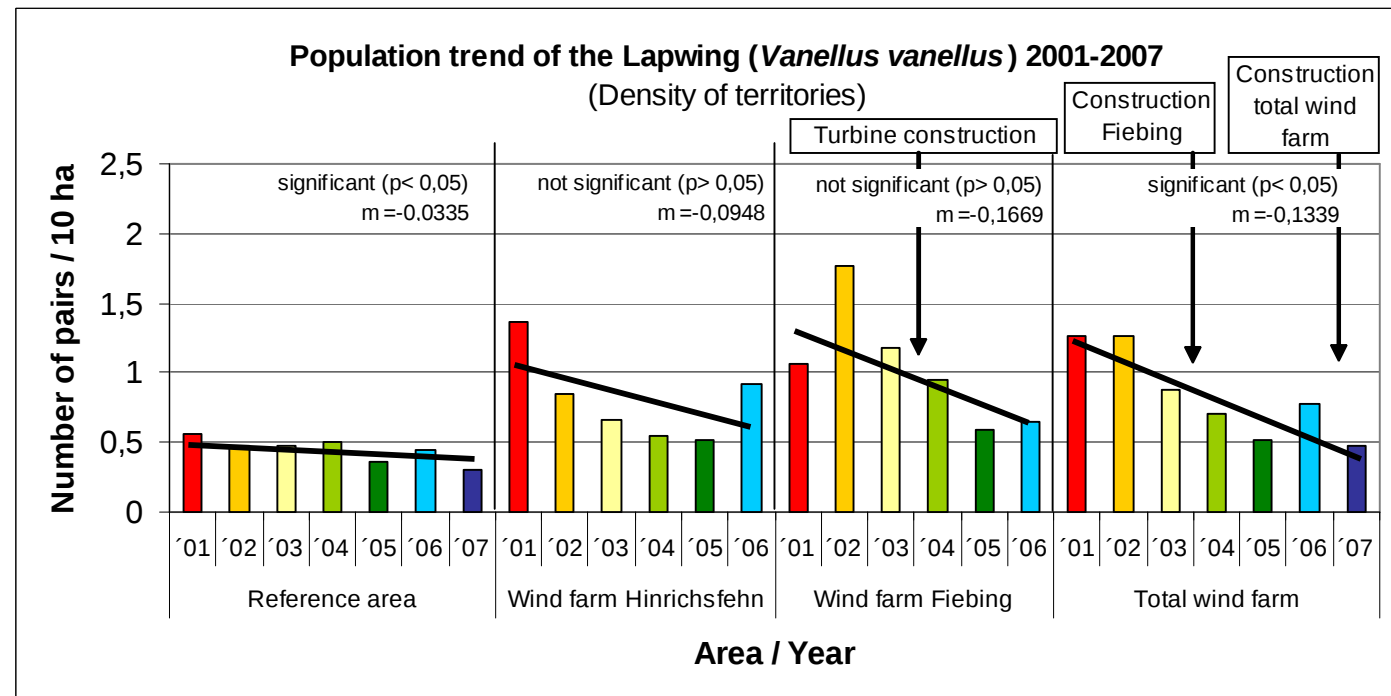
Results

Population trends

**Lapwing:
Breeding population**



Population trends in the wind farms and reference area

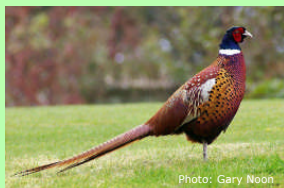


Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Results

Population trends



Population trends in the wind farms and reference area

Negative effects on the population trend for:

Lapwing (*Vanellus vanellus*)

No negative effects on the population trend for:

Curlew (*Numenius arquata*)

Black-tailed Godwit (*Limosa limosa*)

Meadow Pipit (*Anthus pratensis*)

Skylark (*Alauda arvensis*)

Stonechat (*Saxicola rubicola*)

Partridge (*Perdix perdix*)

Pheasant (*Phasianus colchicus*)



Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

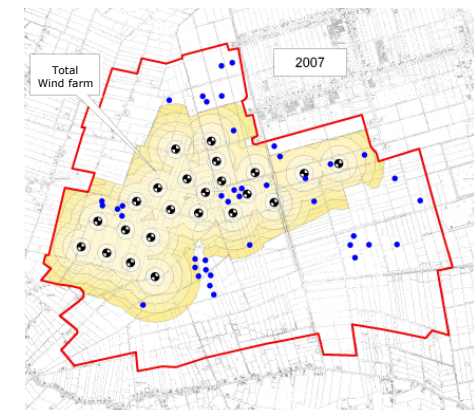
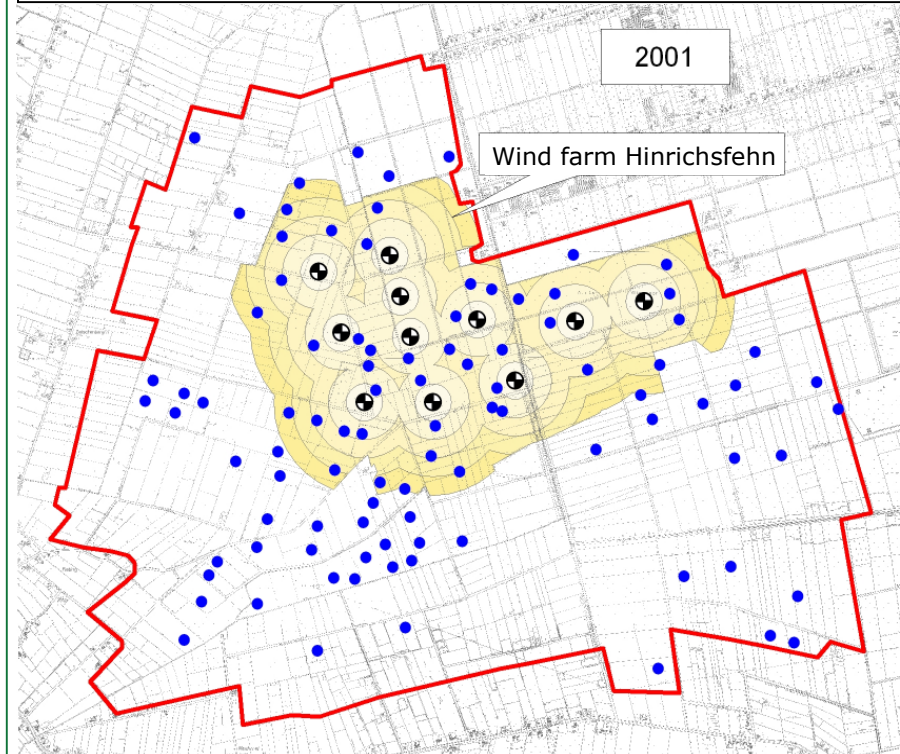
Results

Impact gradient

Lapwing:
Breeding population



Breeding birds: Territory centres and wind turbines Impact – Gradient – Design (IG)



Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

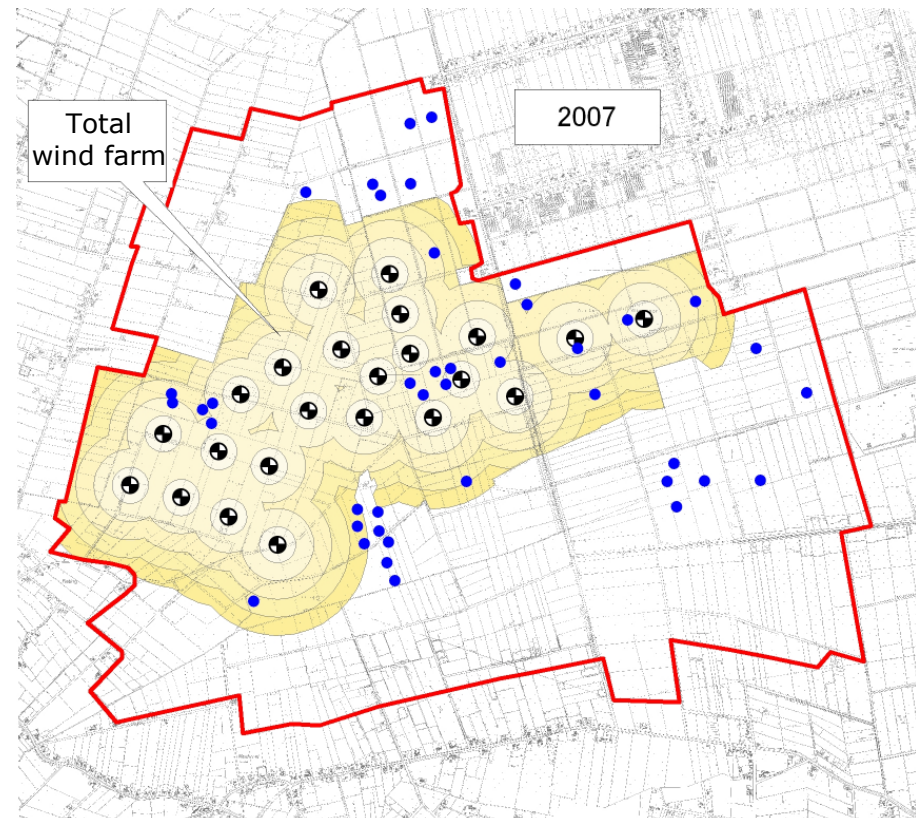
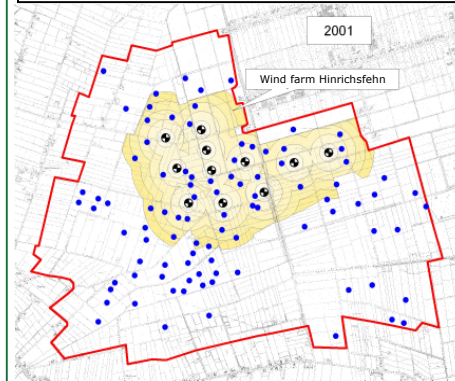
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Impact gradient

Lapwing:
Breeding population



Breeding birds: Territory centres and wind turbines Impact – Gradient – Design (IG)

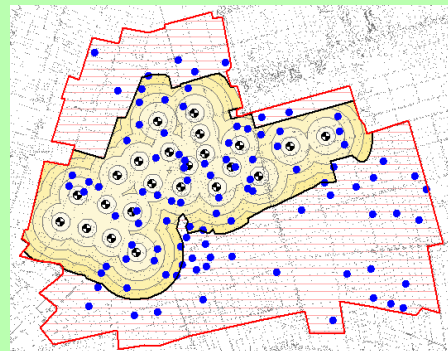
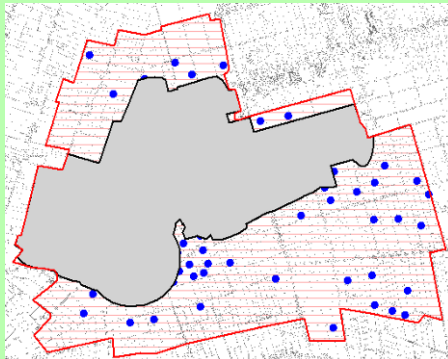


Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Results

Impact gradient



Breeding birds: Territory centres and wind turbines Impact – Gradient – Design (IG)

Expected values:

1. Determination of the density in the reference area
2. Calculation of the expected number of pairs in every distance class based on the reference density
3. Comparison of the real and the expected values

Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

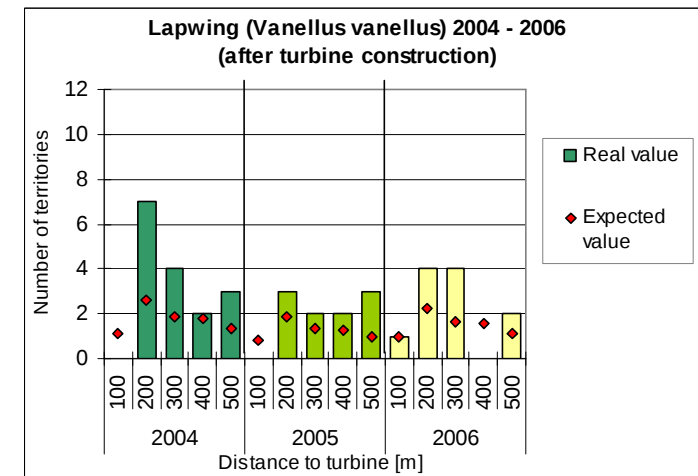
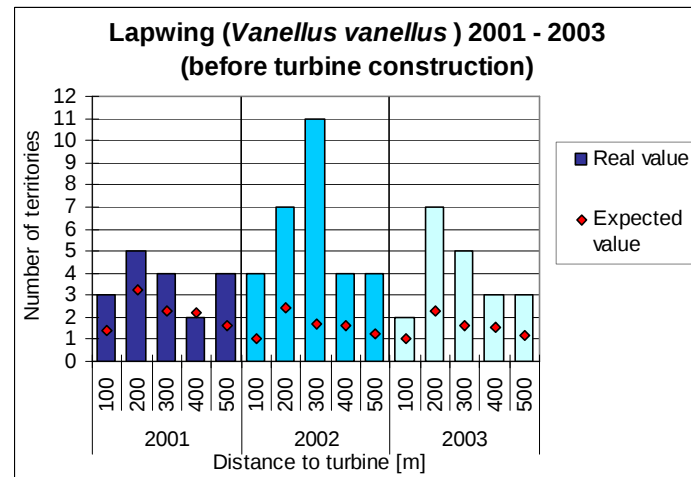
Results

BACI / IG

Lapwing: Breeding population



Before-After-Control-Impact (BACI) combined with Impact Gradient (IG)



Results of the Mann-Whitney U-Test for breeding
Lapwings 2001 - 2007

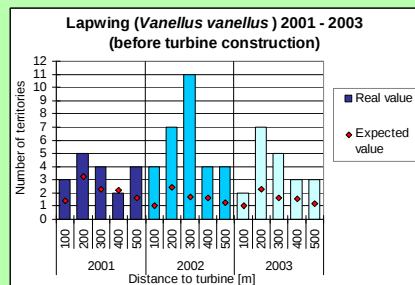
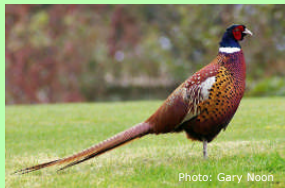
Lapwing	Distance class		
	100	200	300
Real value	8	79	42
Expected value	17	40	31
Significance	p < 0,05	p < 0,01	p > 0,05

Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Results

BACI / IG



Before-After-Control-Impact (BACI) combined with Impact Gradient (IG)

Significant displacement (100 m):

Lapwing (*Vanellus vanellus*)

Meadow Pipit (*Anthus pratensis*)

Displacement (100 m, not significant):

Black-tailed Godwit (*Limosa limosa*)

Curlew (*Numenius arquata*)

Skylark (*Alauda arvensis*)

No displacement:

Stonechat (*Saxicola rubicola*)

Partridge (*Perdix perdix*)

Pheasant (*Phasianus colchicus*)



Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

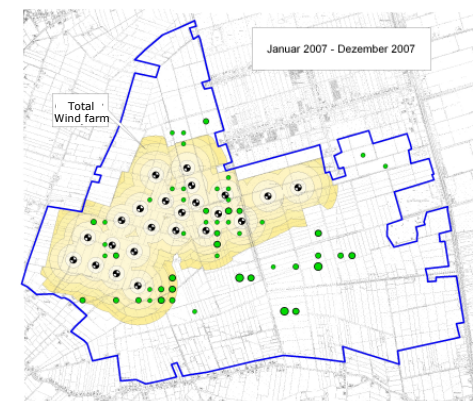
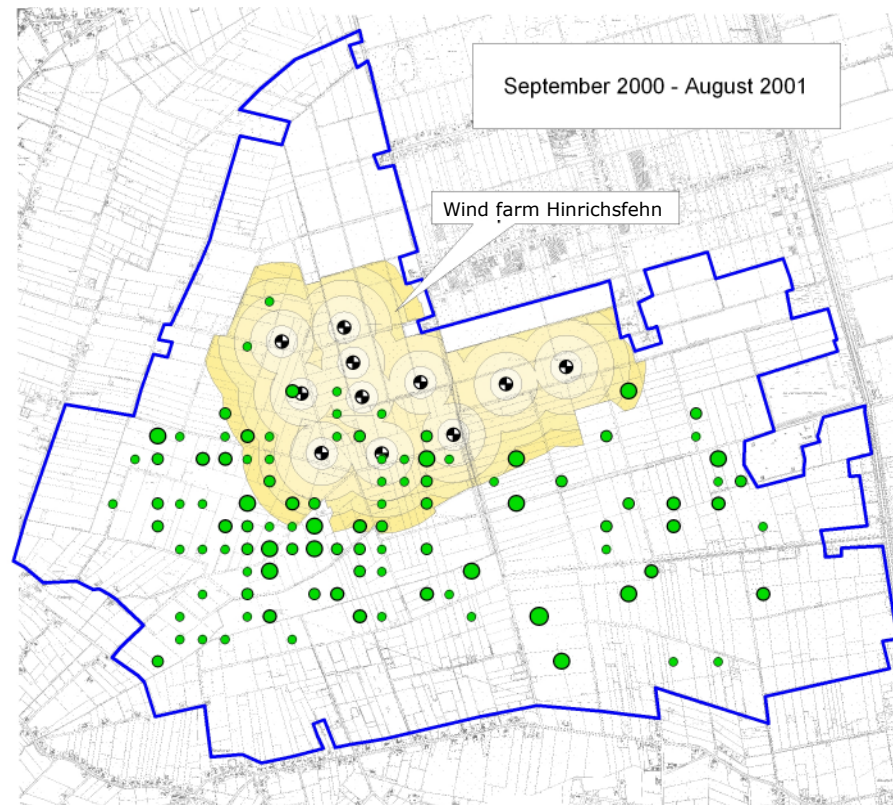
Results

Impact gradient

Lapwing: Staging birds



Staging birds: Individuals and wind turbines Impact – Gradient – Design (IG)



Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

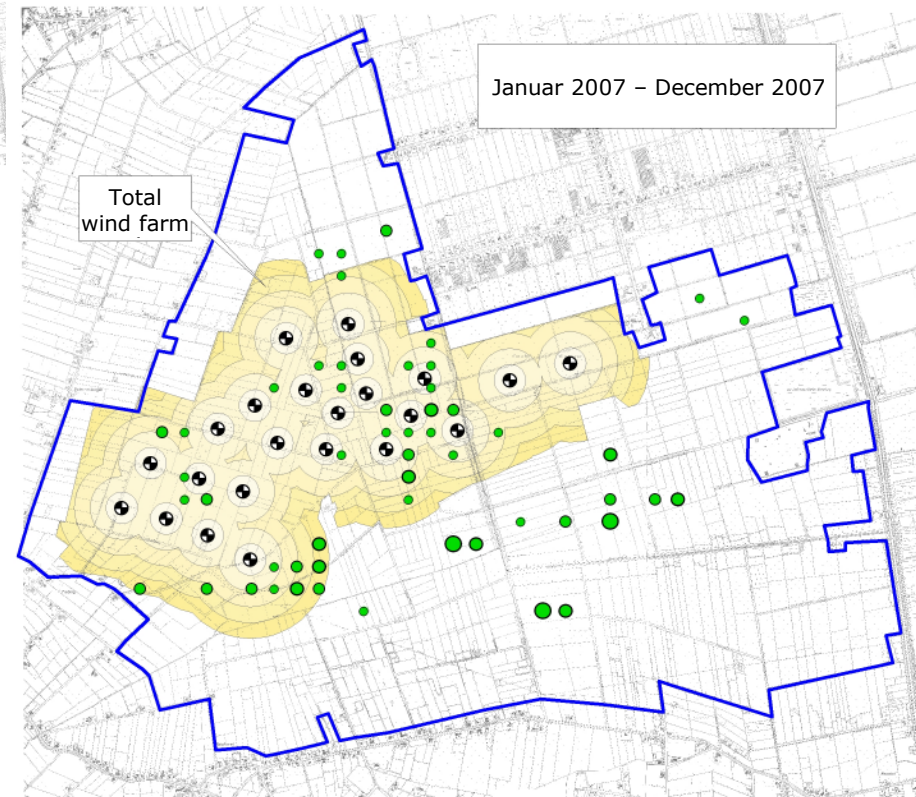
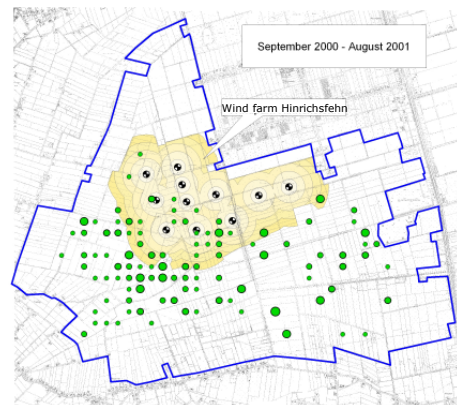
Results

Impact gradient

Lapwing:
Staging birds



Staging birds: Individuals and wind turbines Impact – Gradient – Design (IG)

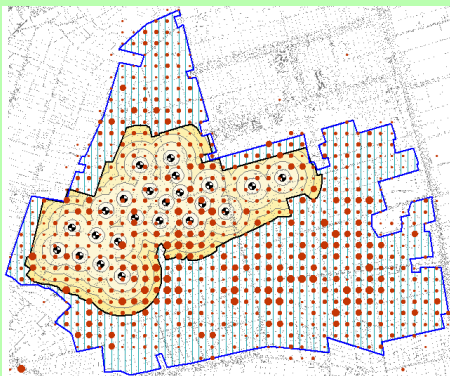
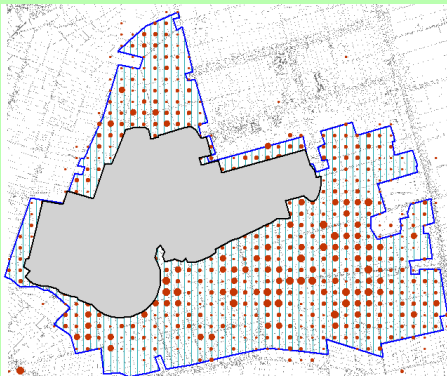


Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Results

BACI / IG



Before-After-Control-Impact (BACI) combined with Impact Gradient (IG)

Expected values:

1. Determination of the density of individuals in the reference area
2. Calculation of the expected number of individuals in every distance class based on the reference density
3. Comparison of the real and expected values

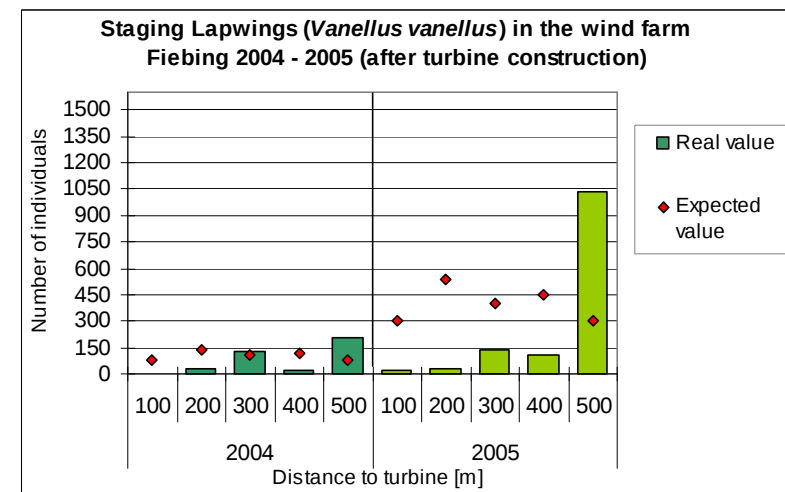
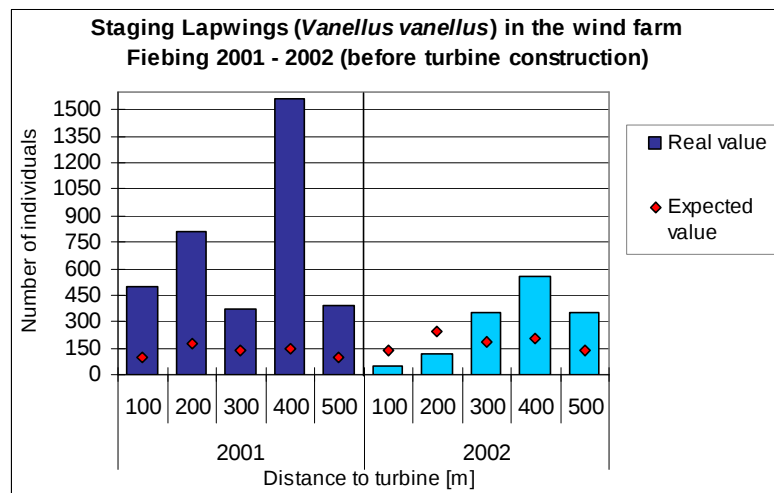
Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Results

BACI / IG

Before-After-Control-Impact (BACI) combined with Impact Gradient (IG)



Lapwing: Staging birds



Results of the Mann-Whitney U-Test for staging Lapwings 2001 - 2007

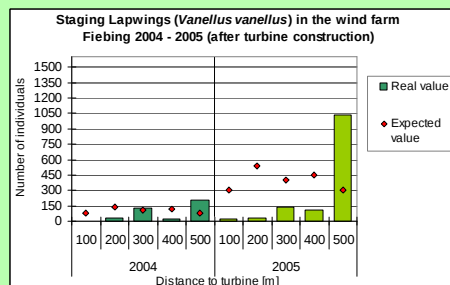
Lapwing	Distance class		
	100	200	300
Real value	216	1863	2069
Expected value	1266	3370	2638
Significance	p < 0,01	p < 0,05	p > 0,05

Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Results

BACI / IG



Before-After-Control-Impact (BACI) combined with Impact Gradient (IG)

Significant displacement

(200 m, in single years up to 400 m):

Lapwing (*Vanellus vanellus*)

Significant displacement (100 m):

Fieldfare (*Turdus pilaris*)

Starling (*Sturnus vulgaris*)

Chaffinch (*Fringilla coelebs*)

Common Wood Pigeon

(*Columba palumbus*)

Displacement (100 m, not significant):

Jackdaw (*Corvus monedula*)

Black-headed Gull

(*Larus ridibundus*)

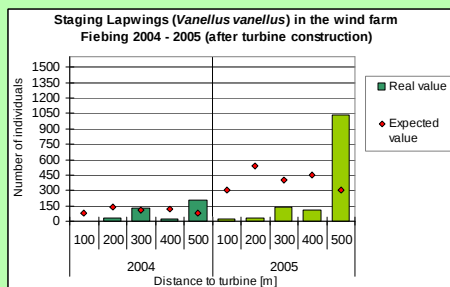


Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Results

BACI / IG



Before-After-Control-Impact (BACI) combined with Impact Gradient (IG)

No displacement:

Meadow pipit (*Anthus pratensis*)

Carrion Crow (*Corvus corone*)

Common Buzzard (*Buteo buteo*)

Common Kestrel (*Falco tinnunculus*)

Grey Heron (*Ardea cinerea*)

Common Gull (*Larus canus*)



Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

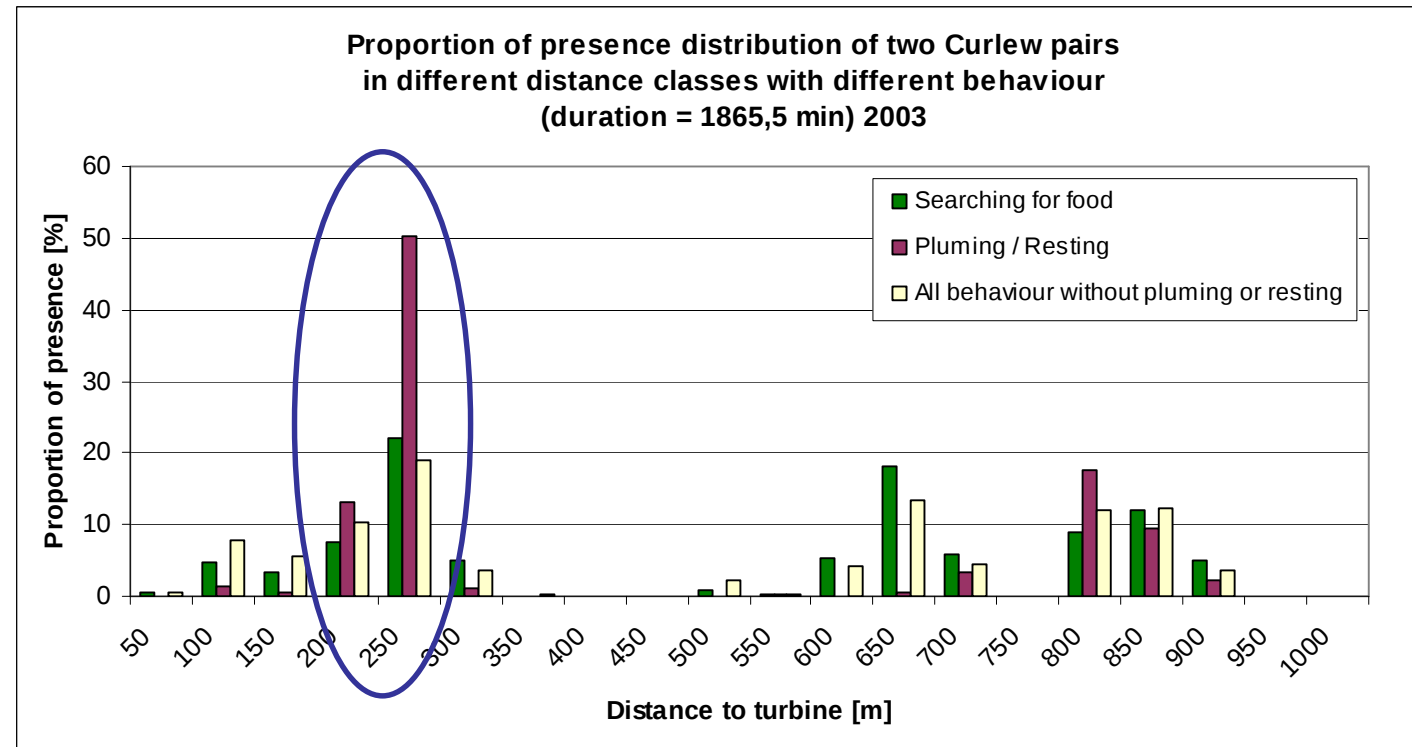
Results

Behaviour recording

Curlew (*Numenius arquatus*)



Behaviour recording Curlew



Pair 1

Pair 2

Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Results

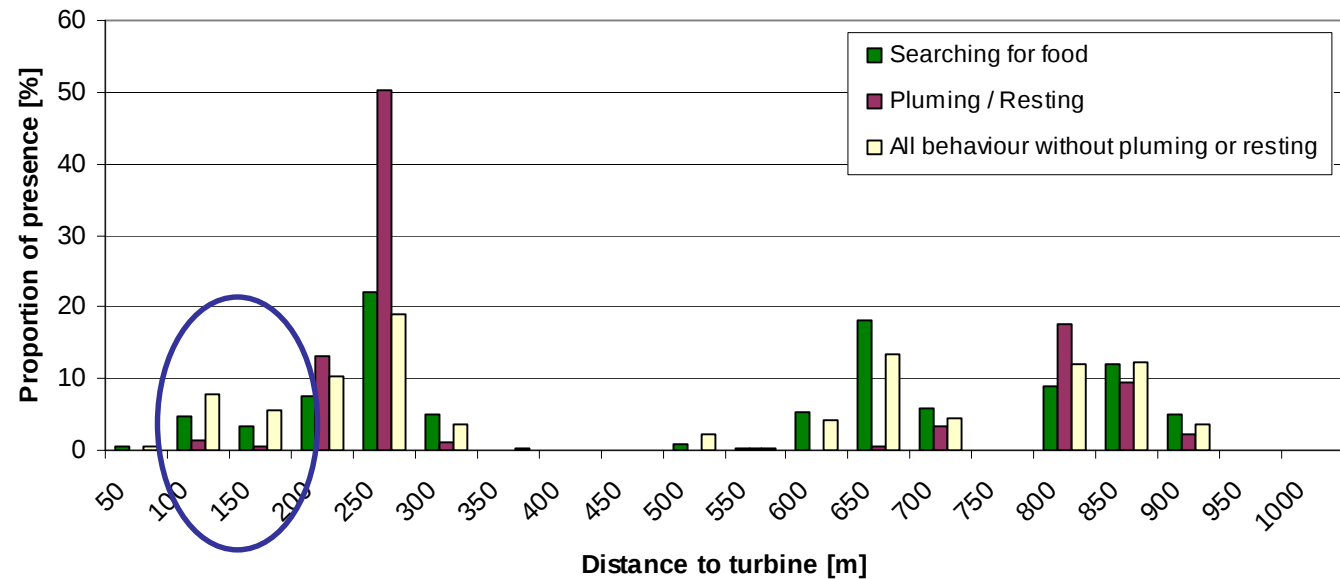
Behaviour recording

Curlew (*Numenius arquatus*)



Behaviour recording Curlew

Proportion of presence distribution of two Curlew pairs
in different distance classes with different behaviour
(duration = 1865,5 min) 2003



Pair 1

Pair 2

Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

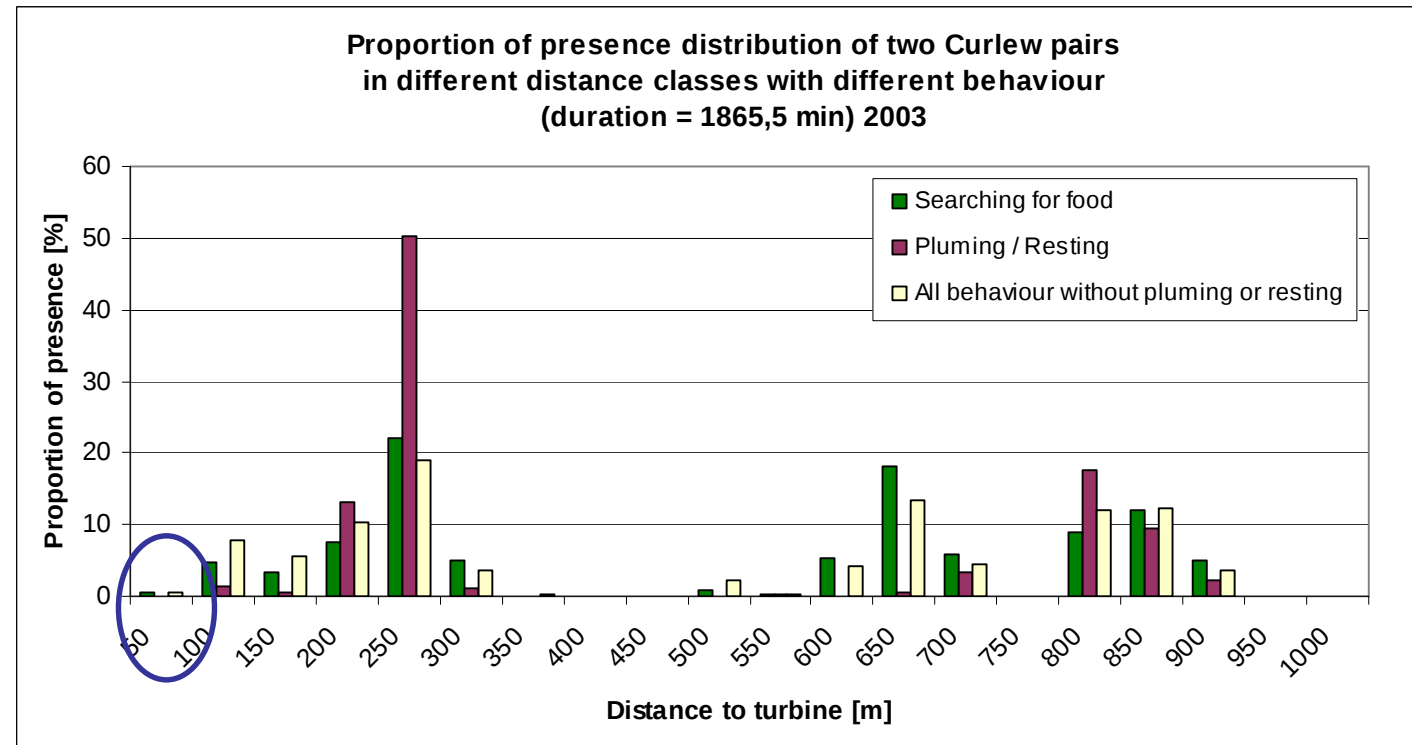
Results

Behaviour recording

Curlew (*Numenius arquatus*)



Behaviour recording Curlew



Pair 1

Pair 2

Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

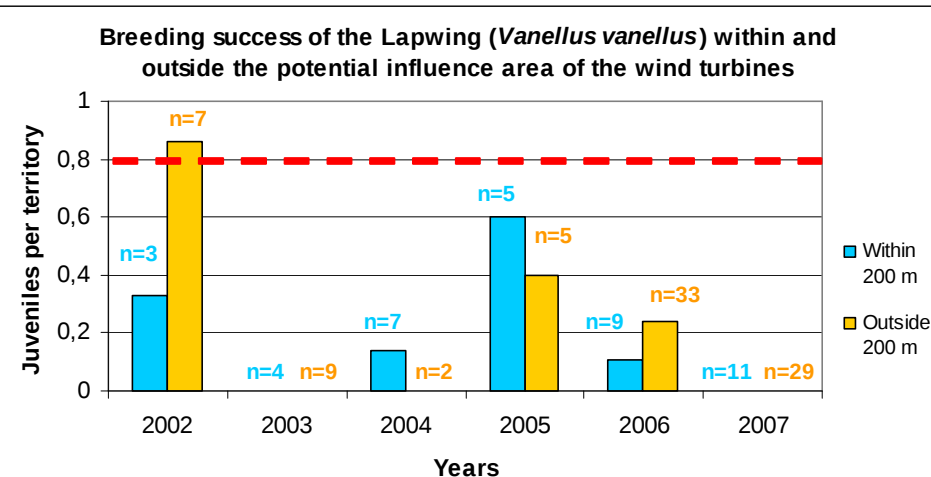
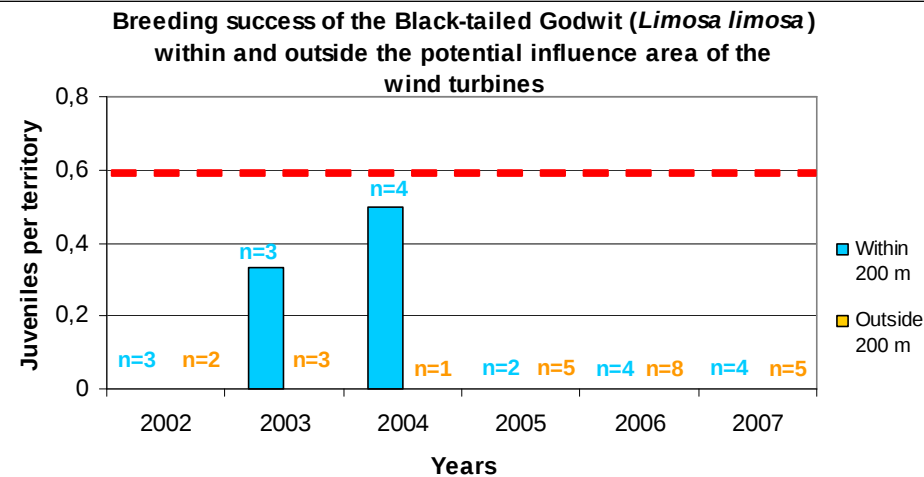
Results

Breeding success

Black-tailed Godwit (*Limosa limosa*)

Lapwing (*Vanellus vanellus*)

Breeding success 2002-2007



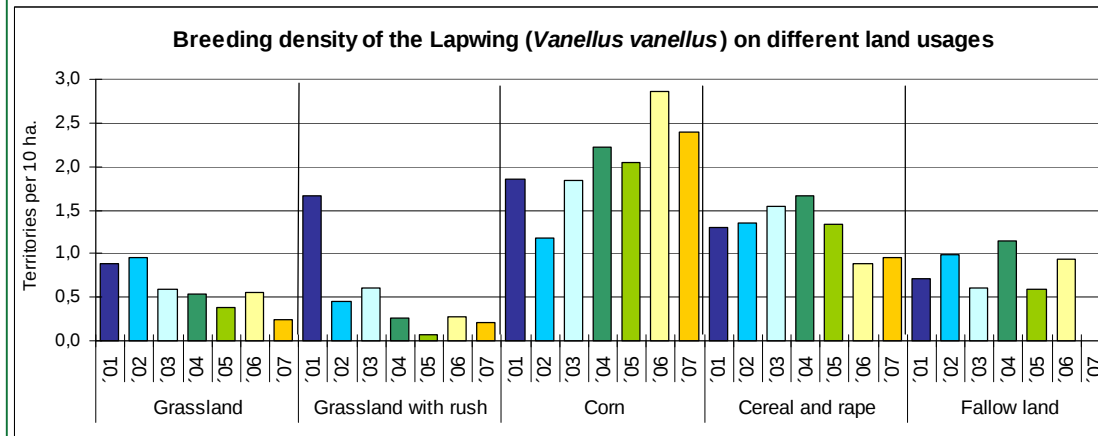
Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

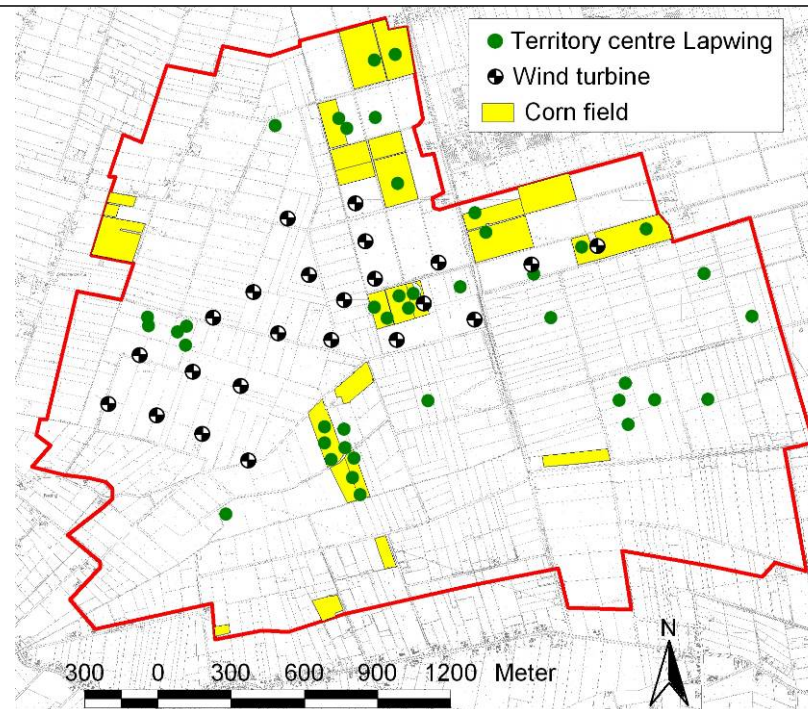
Results

Land usage

Breeding Lapwing: Preference for corn



Lapwing Breeding birds



Distribution of the Lapwing (*Vanellus vanellus*) territory centres and corn fields

Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

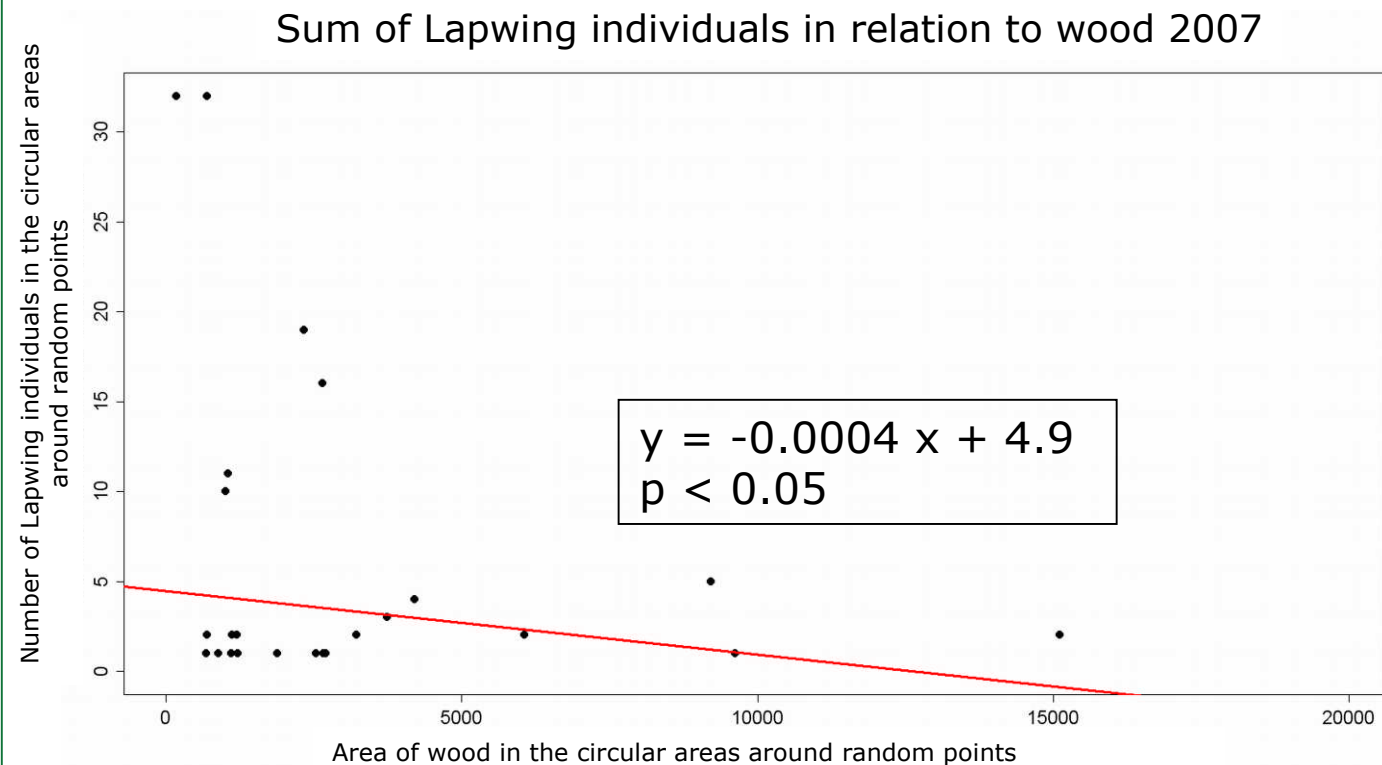
Results

Land usage

Lapwing
Breeding birds



Breeding Lapwing: Avoidance of woods and hedges



→ No significant linear regression between the number of breeding Lapwing individuals and the distance to the next wind turbine.

Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Results

Habitat modelling

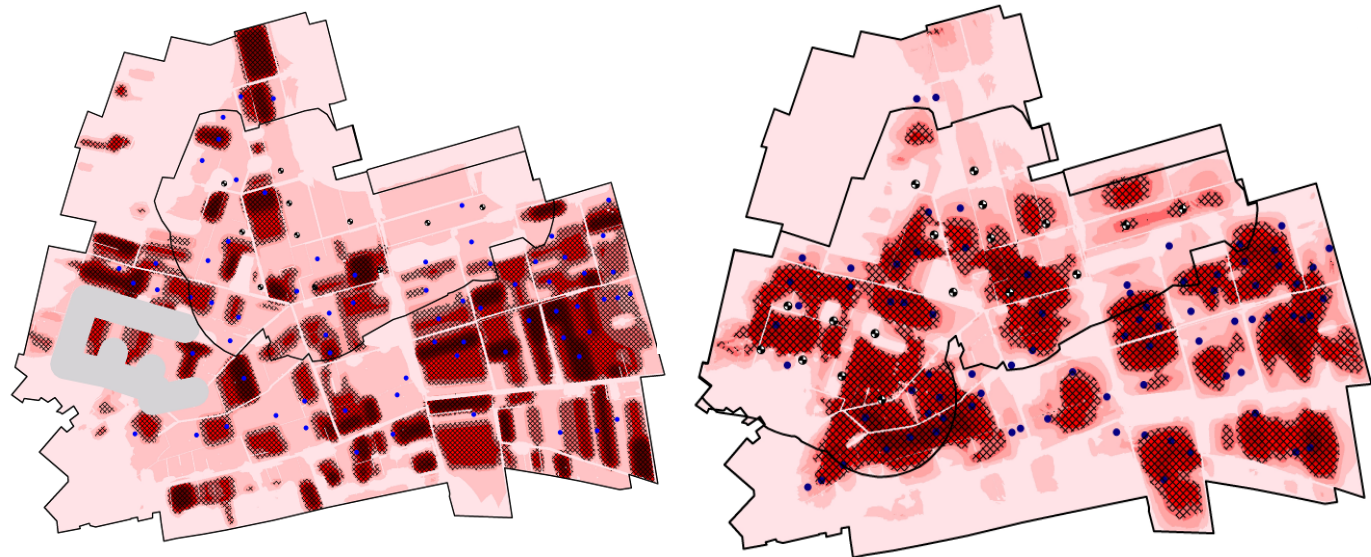
2003 - 2006

**Skylark
Breeding birds**



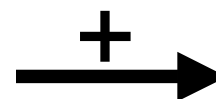
Photo: Daniel Pettersson

Determination of habitat quality with multiple habitat models (logistic regression) - **Skylark**



Density 2003:

Wind farm area:
0,35 Territories
per ha of good habitat
Reference area:
0,17 Territories
per ha of good habitat



Density 2006:

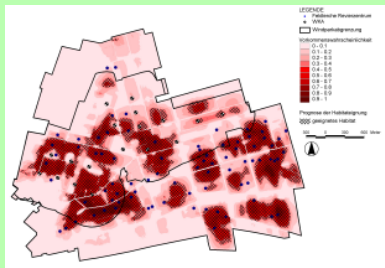
Wind farm area:
0,21 Territories
per ha of good habitat
Reference area:
0,35 Territories
per ha of good habitat

Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Results

Habitat modelling



Results of the habitat modelling:

- Breeding density in good habitat in the wind farm area equal or higher than in the reference area

→ no influence of the wind farm

Lapwing, Black-tailed Godwit, Meadow Pipit, Stonechat, Pheasant (2006)

- Higher breeding density in the good habitat of the wind farm area in 2003, lower density in the good habitat of the wind farm area in 2006

→ decrease in wind farm & increase in reference area

Skylark → Long term effect?

Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Literature review

Curlew
(*Numenius arquatus*)



Results of the literature review for the Curlew:

- Only 4 studies (all IG – design)
- In Germany little or no impact
- In Scotland up to 800 m
 - Different habitats
 - Agricultural areas with more disturbance in Germany

Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Literature review

Results of the literature review for the Skylark:

- 16 studies
- 2 with BACI
- No long term study
- Mostly „no impact“
- Again in Scotland an impact up to 200 m

Skylark (*Alauda arvensis*)



Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Conclusion



- Staging birds are more sensitive than breeding birds
- Statistically significant displacement (breeding birds) only up to 100 m for Lapwing and Meadow Pipit
- Long term effects for skylark possible (displacement 100 m)
- Habitat parameters have more influence on distribution of breeding birds
- Most sensitive staging bird: Lapwing (displacement 200-400m)
- Results from other studies in other habitats can deviate



vs.



Windturbines and meadow birds in Germany

Results of a 7 year BACI-study and a literature review

Thank you very much
for your attention!

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info@ecodata-steinborn.de

Black-tailed Godwit

