



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

Windturbines and Meadow Birds in Germany

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Results of a 7-Year BACI Study

Marc Reichenbach & Hanjo Steinborn



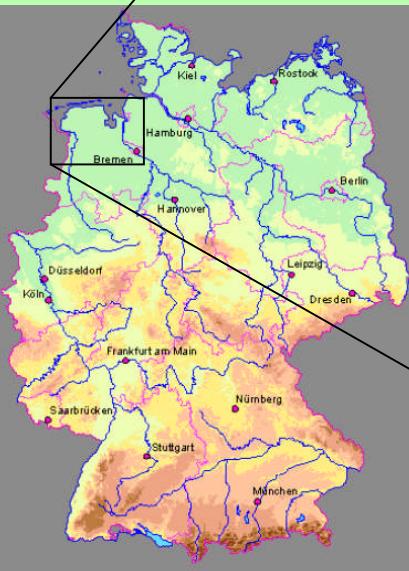
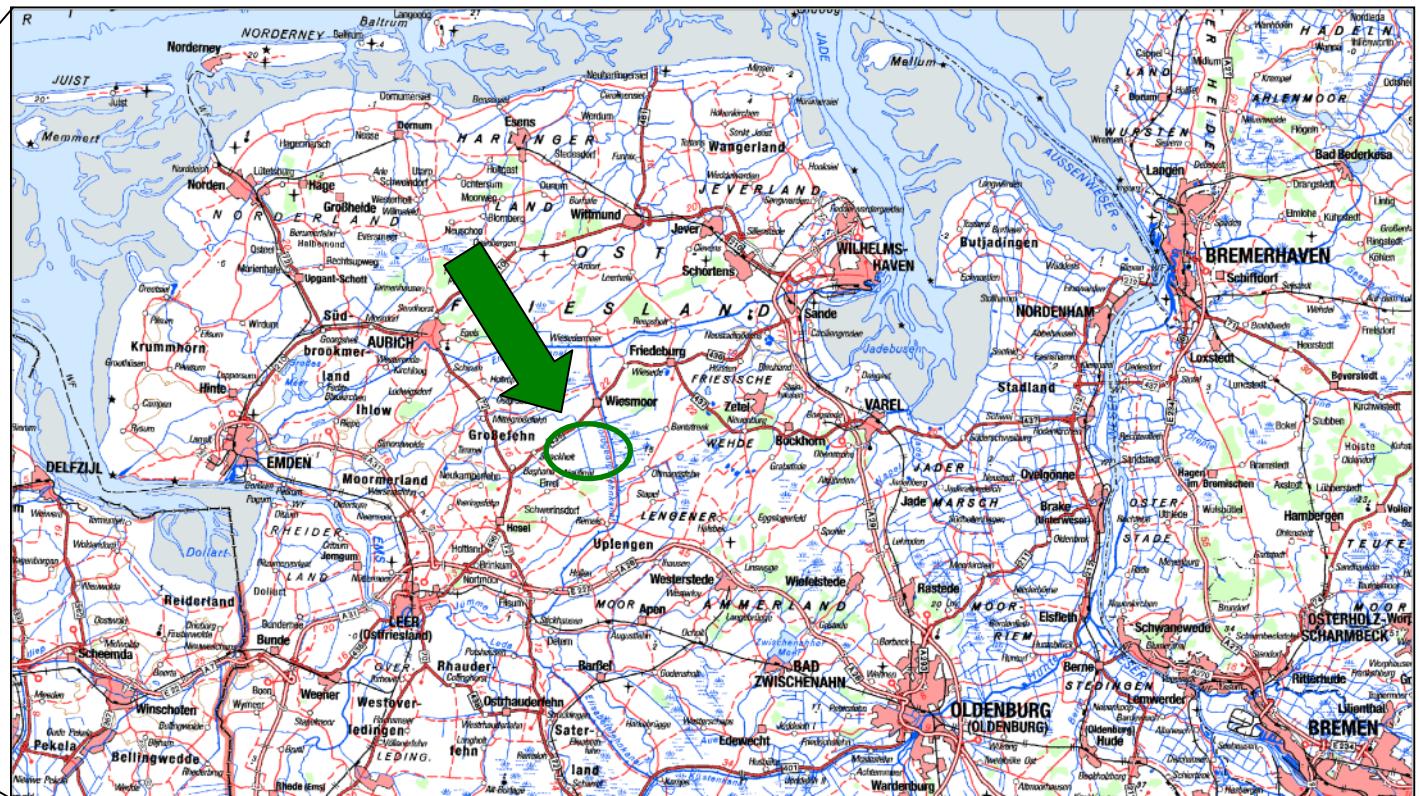
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Methods

Study area

Location of the study area:

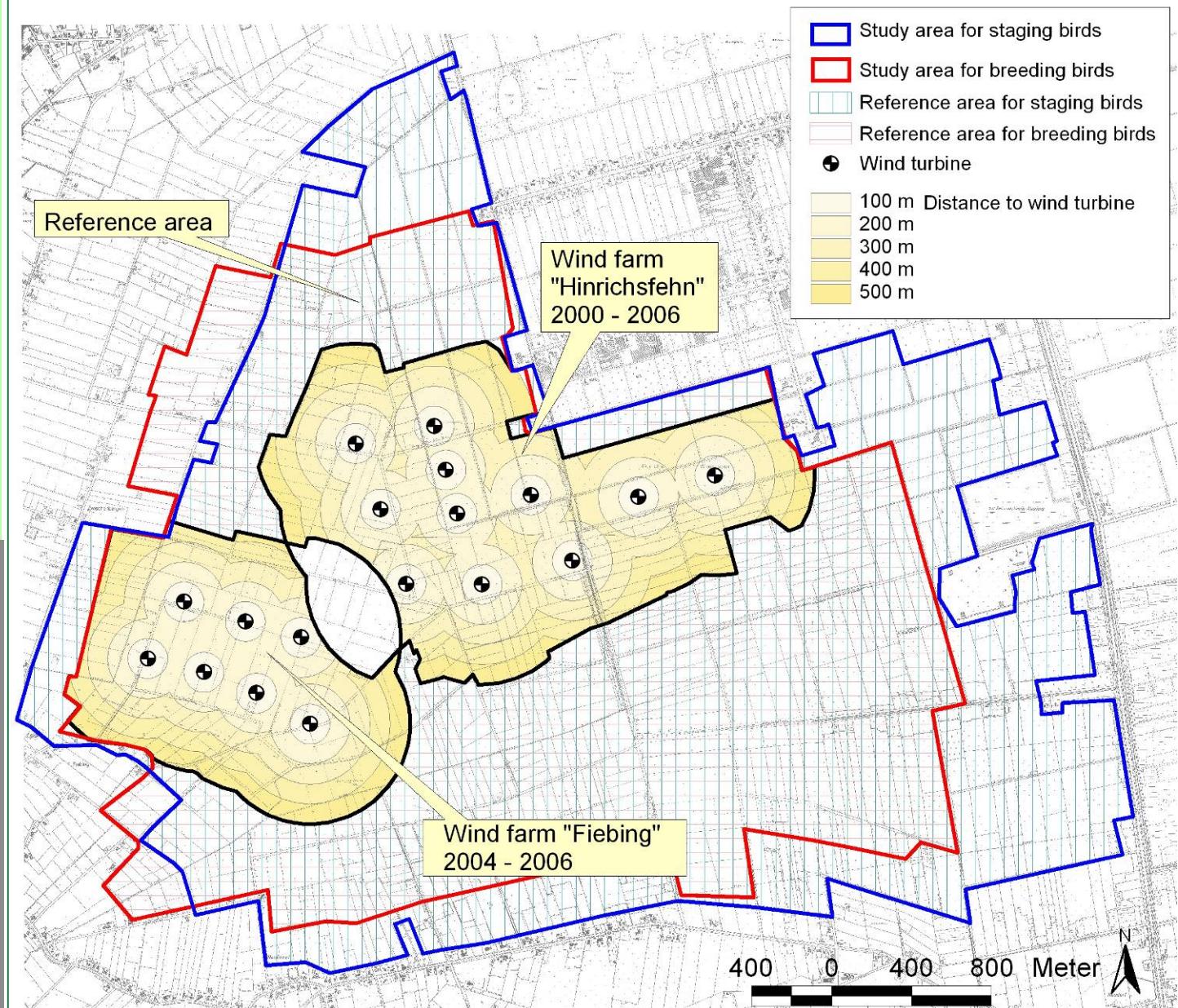
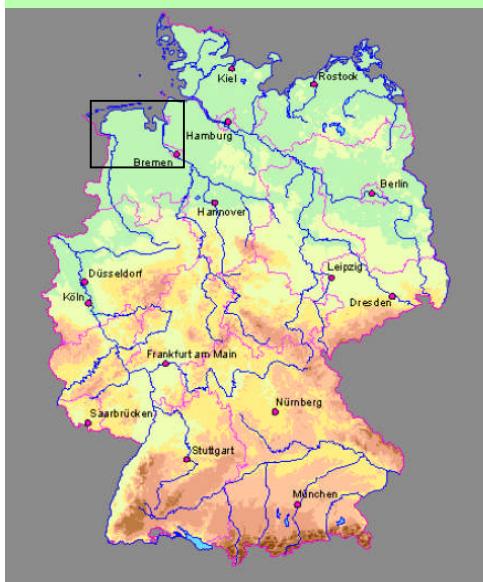


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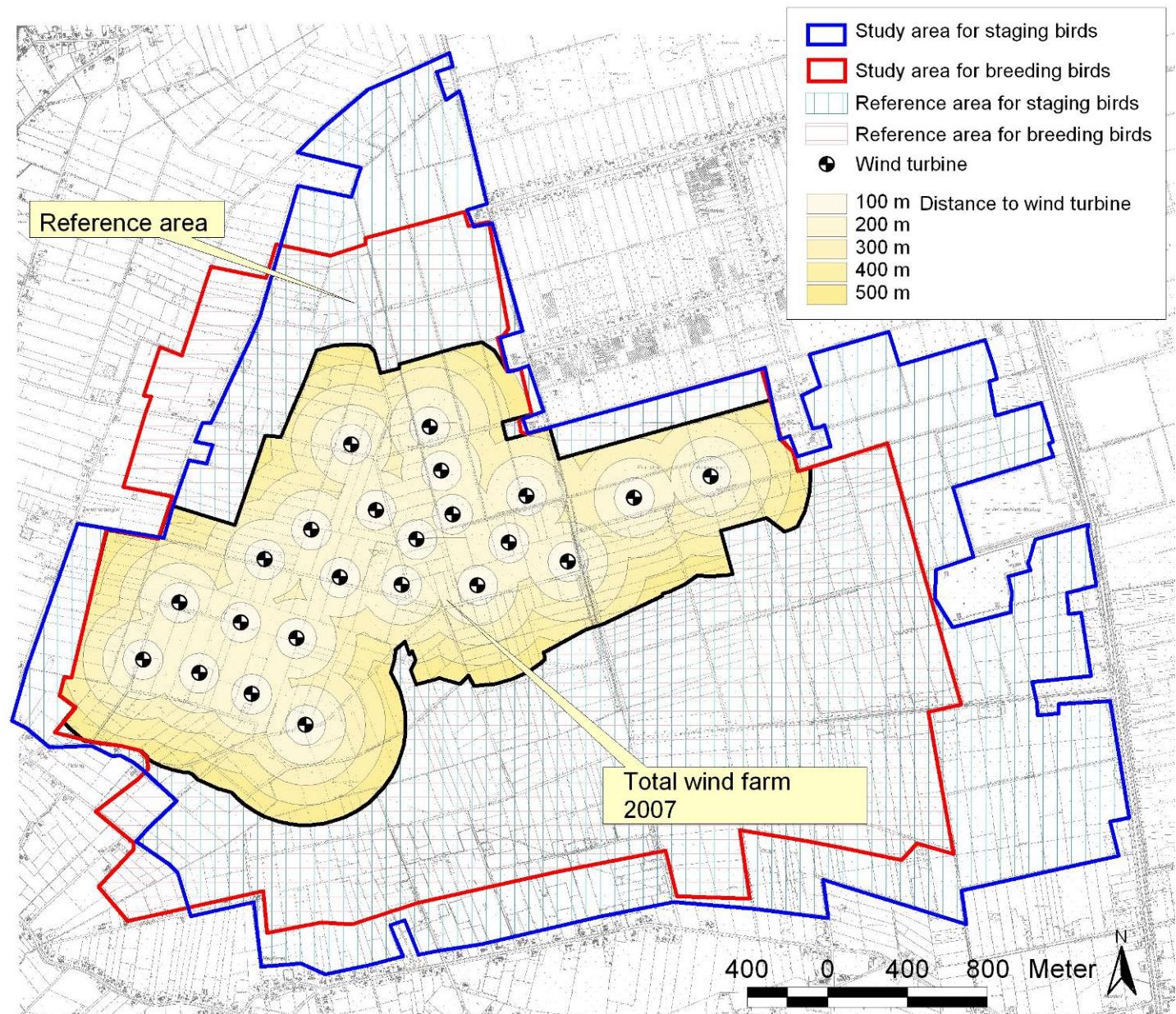
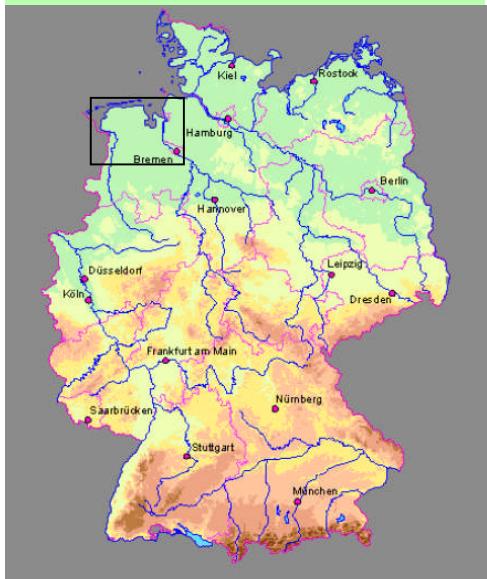


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Methods

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)



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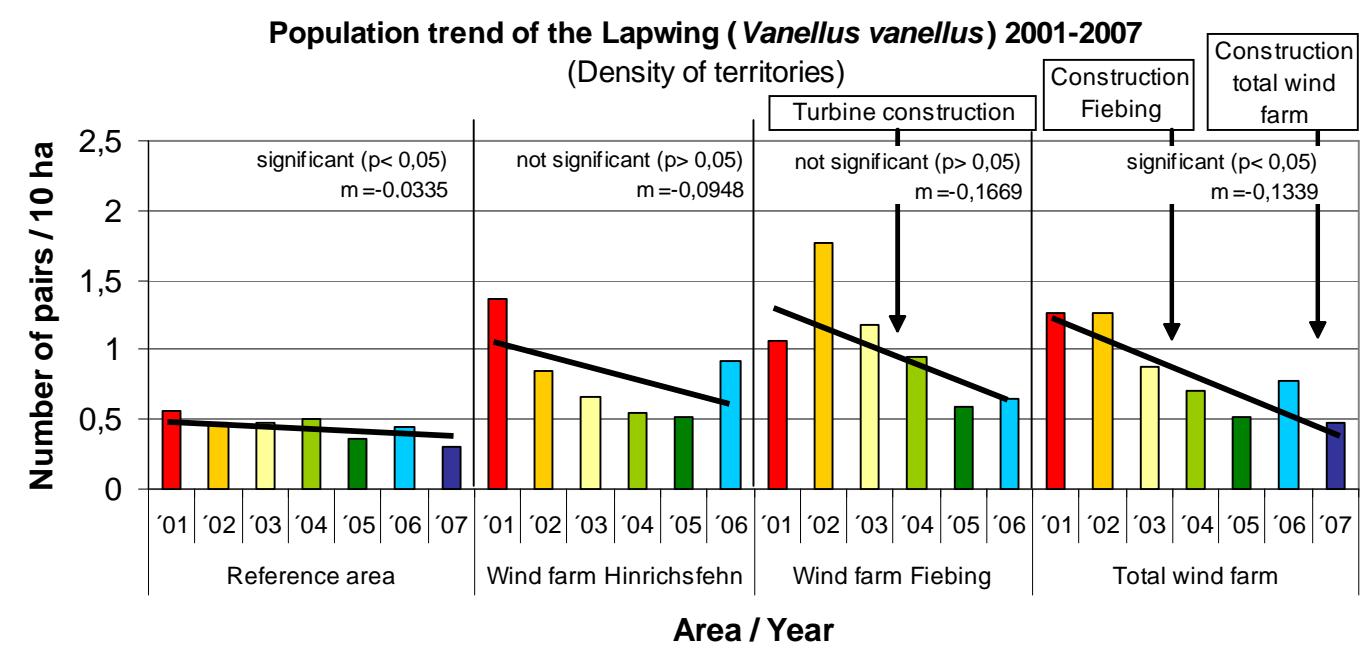
Results

Population trends

Lapwing: Breeding population



Population trends in the wind farms and reference area



Windturbines and meadow birds in Germany

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Results

Population trends



Photo: Robert Lorch



Photo: Klaus Reinkie



Photo: Gary Noon

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*)



Photo: Alan D. Wilson



Photo: Andreas Trepte



Photo: Andreas Trepte



Photo: Daniel Pettersson

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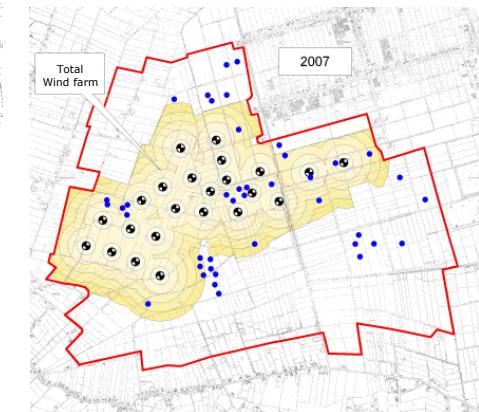
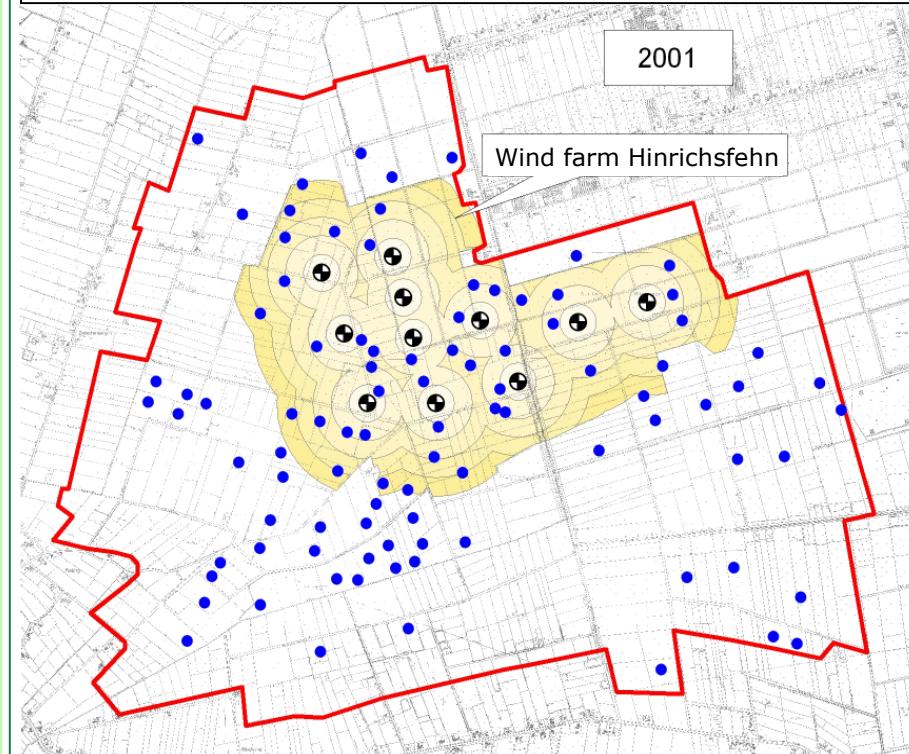
Results

Impact gradient

Lapwing: Breeding population



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



Windturbines and meadow birds in Germany

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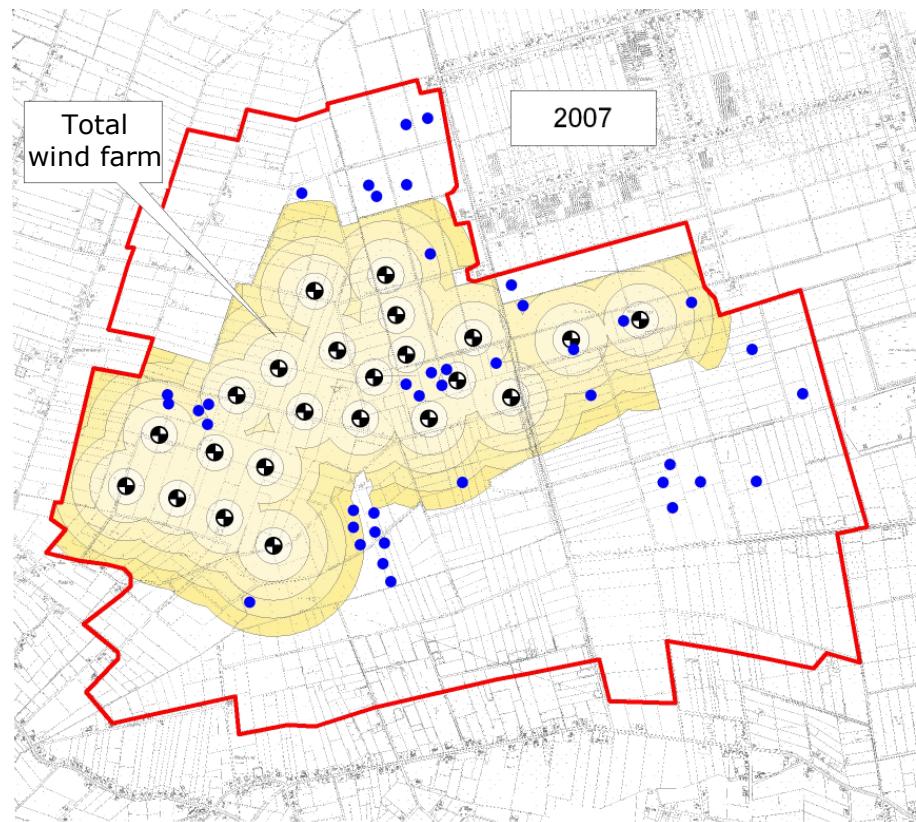
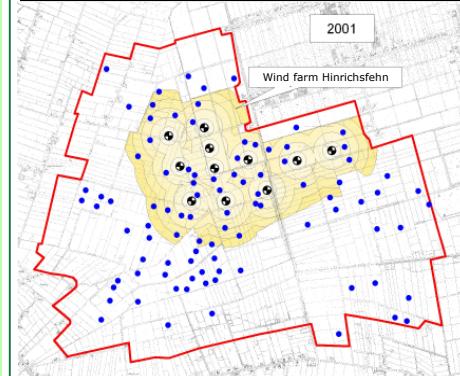
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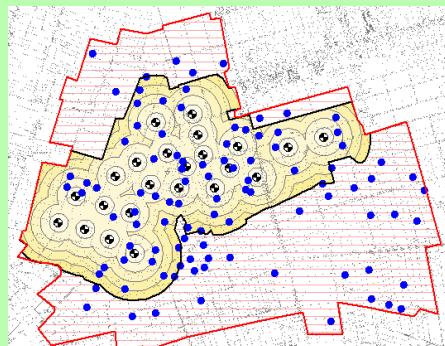
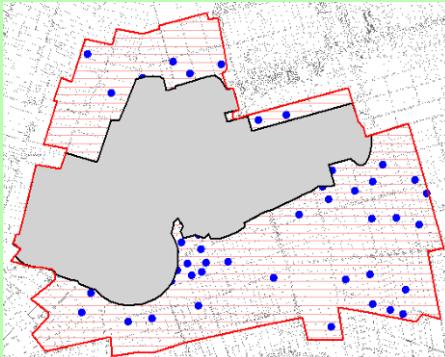


Windturbines and meadow birds in Germany

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

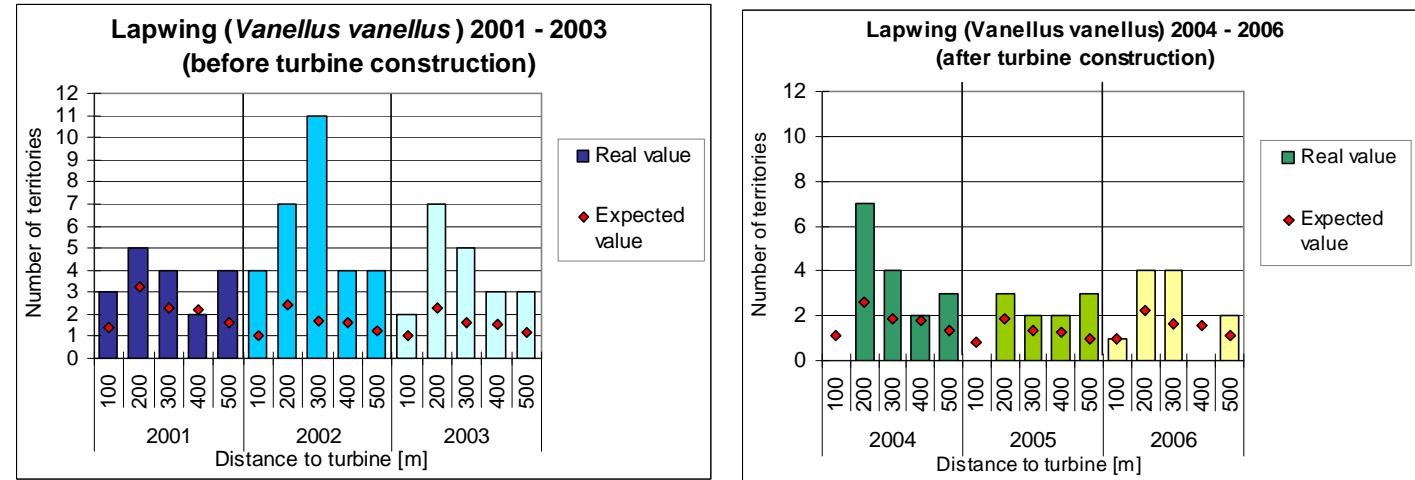
Results

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



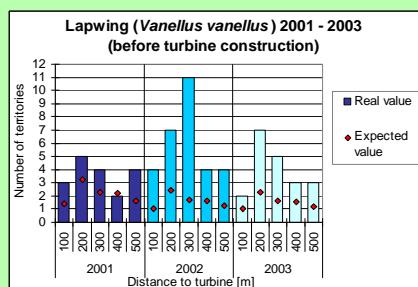
Photo: Robert Lorch



Photo: Klaus Reulke



Photo: Gary Noon



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

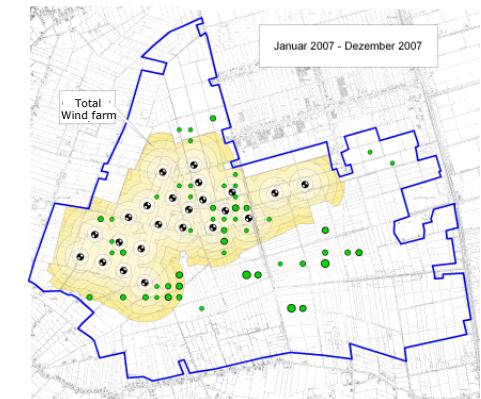
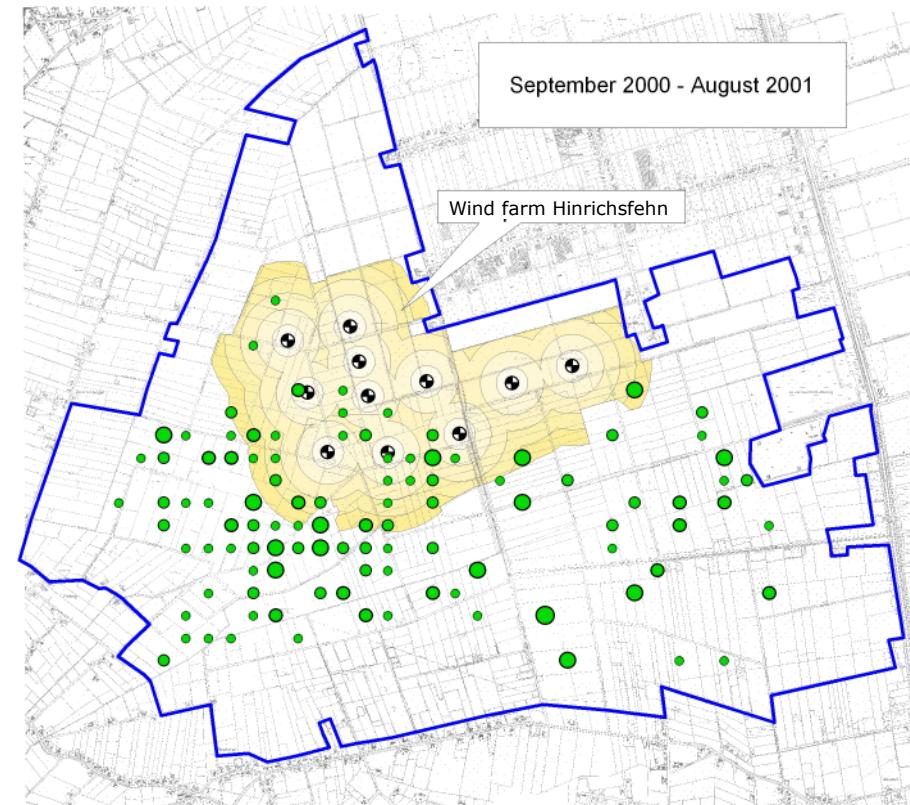
Results

Impact gradient

Lapwing: Staging birds



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



Windturbines and meadow birds in Germany

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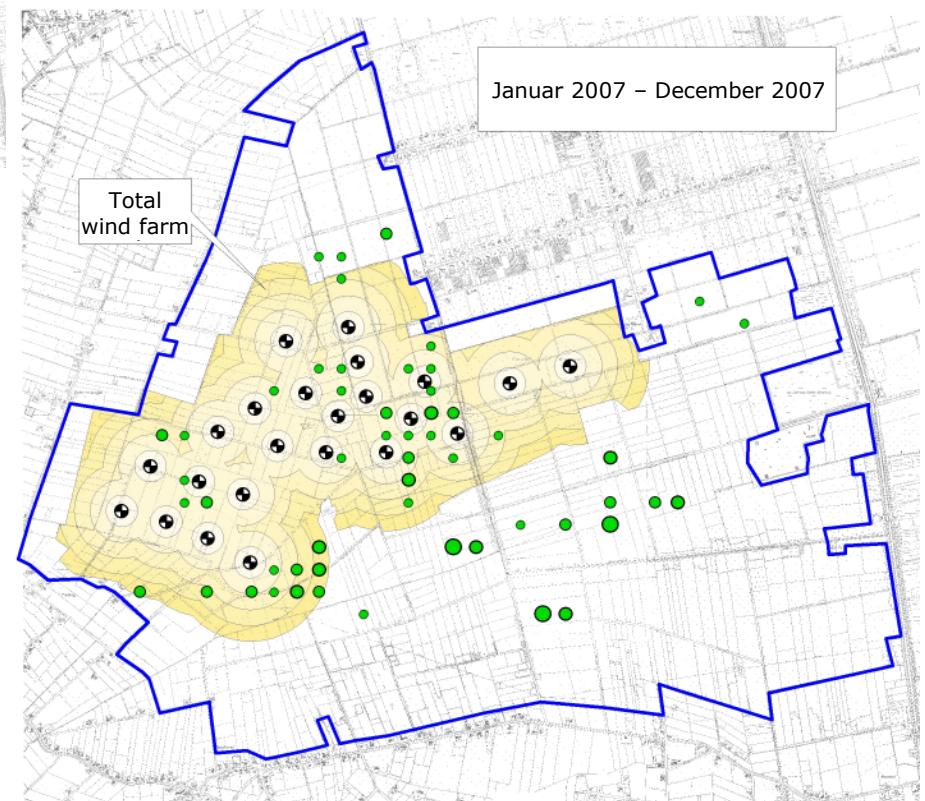
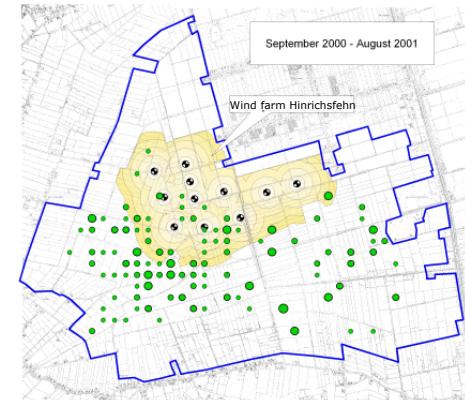
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Impact gradient

Lapwing: Staging birds



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

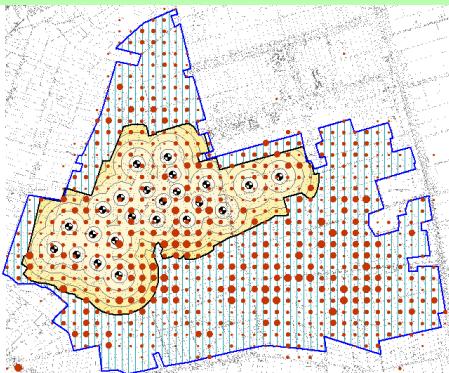
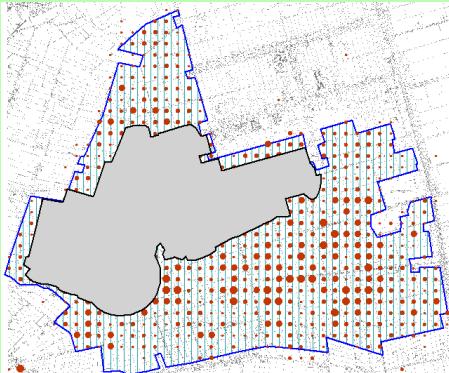


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Results of a 7 year BACI-study and a literature review

Results

BACI / IG



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

Expected values:

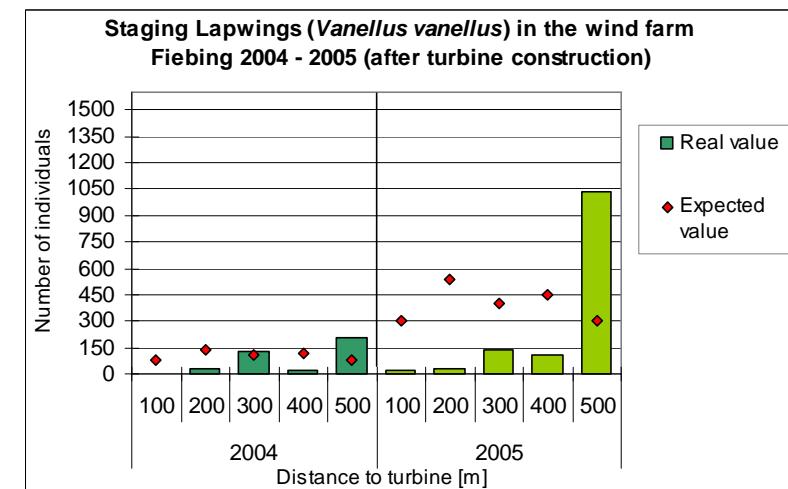
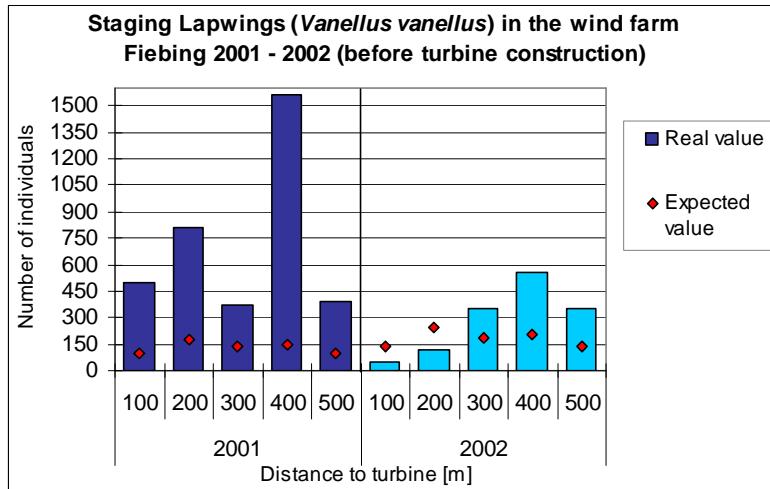
1. Determination of the density of individuals in the reference area
2. Calculation of the expected number of individuals in every distance class based on the reference density
3. Comparison of the real and expected values

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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

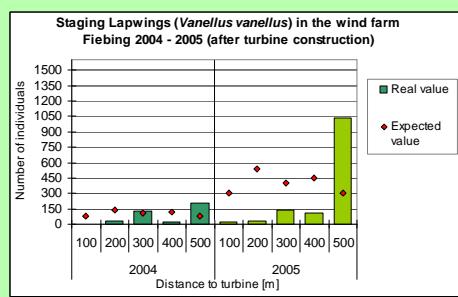
Lapwing	Distance class		
	100	200	300
Real value	216	1863	2069
Expected value	1266	3370	2638
Significance	p < 0,01	p < 0,05	p > 0,05

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*)



Photo: Martin Olsson



Photo: Marek Szczepanek



Photo: MichaelMaggs



Photo: Andreas Treptes

Displacement (100 m, not significant):

Jackdaw (*Corvus monedula*)

Black-headed Gull

(*Larus ridibundus*)

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Results

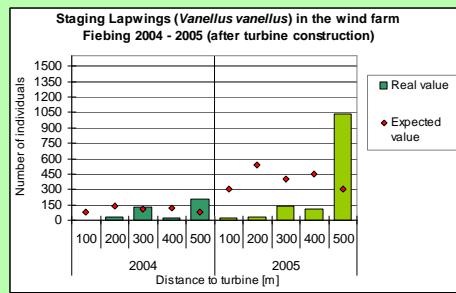
BACI / IG



Photo: J. M. Garg



Photo: Andreas Trepte



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

No displacement:

Meadow pipit (*Anthus pratensis*)



Photo: Andreas Trepte

Carrion Crow (*Corvus corone*)



Photo: L. B. Tiettenhorn

Common Buzzard (*Buteo buteo*)



Photo: Marek Szczepanek

Common Kestrel (*Falco tinnunculus*)



Photo: Andreas Trepte

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

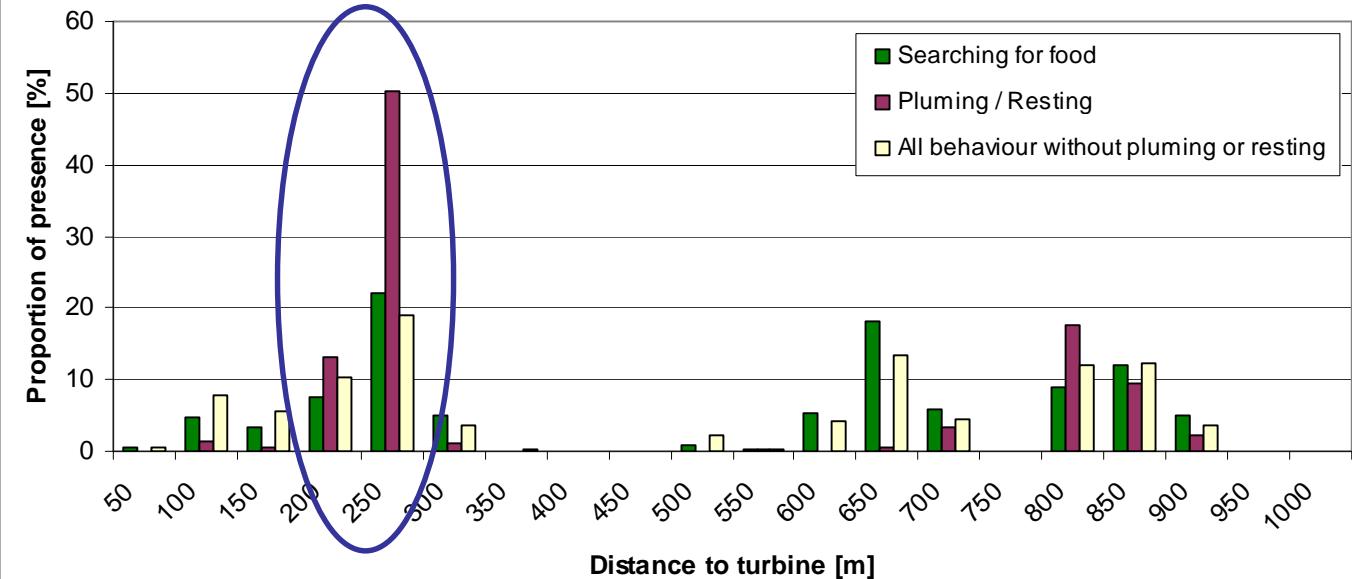
Curlew (*Numenius arquatus*)



Photo: Alan D. Wilson

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

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Results

Behaviour recording

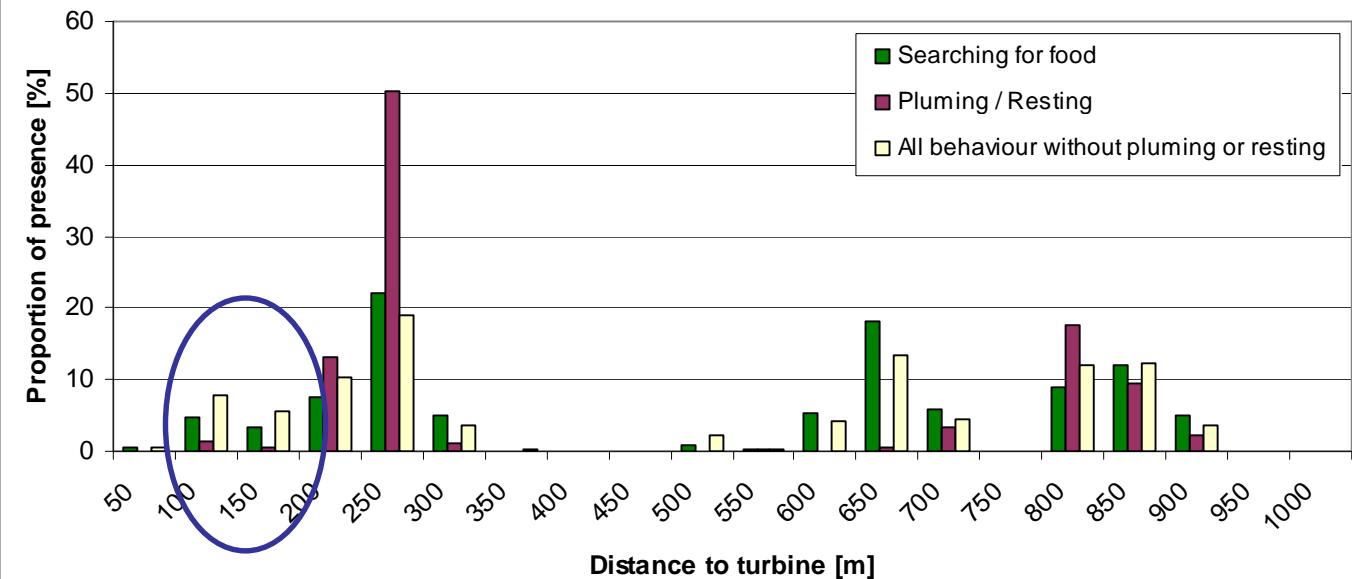
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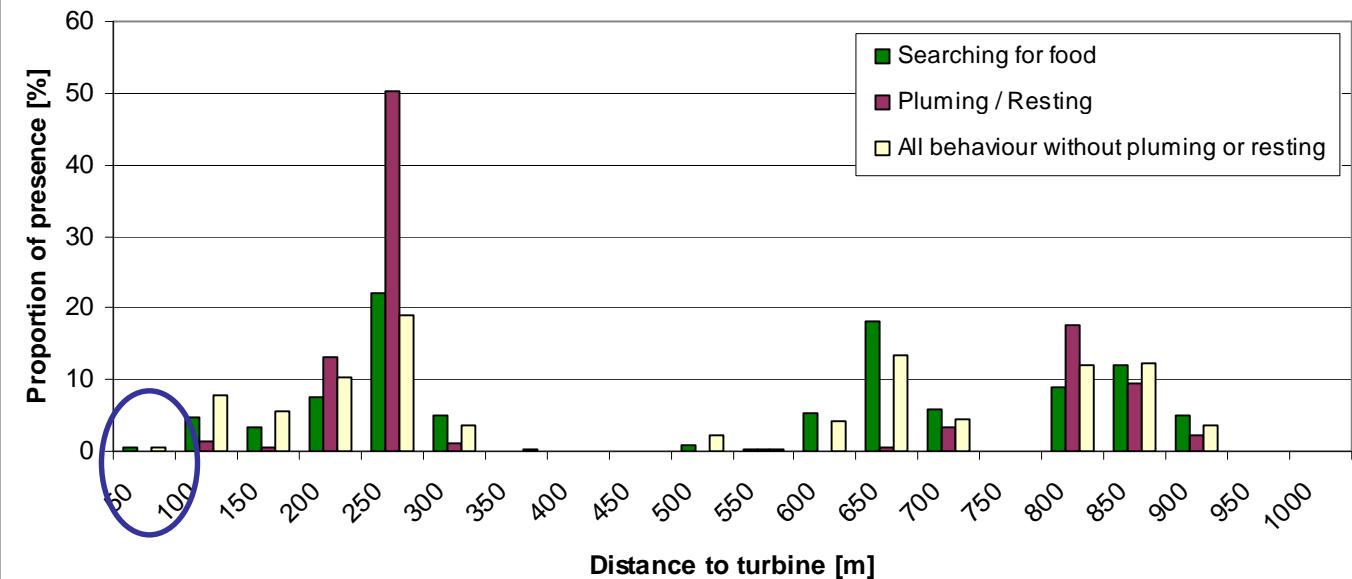
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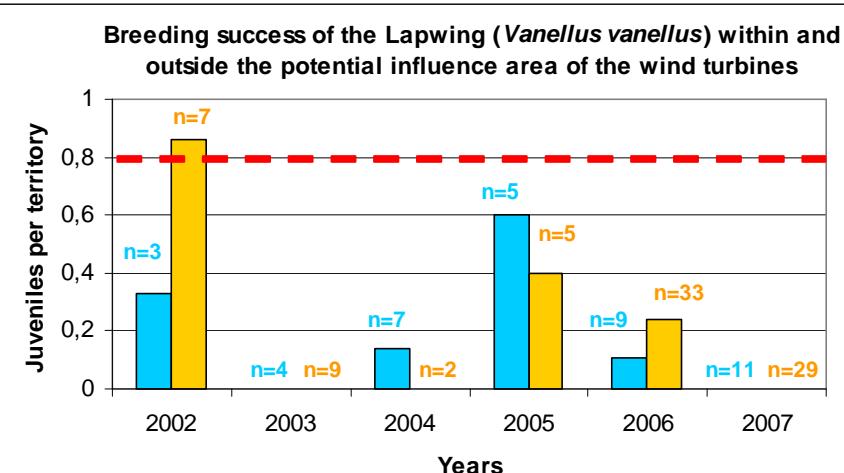
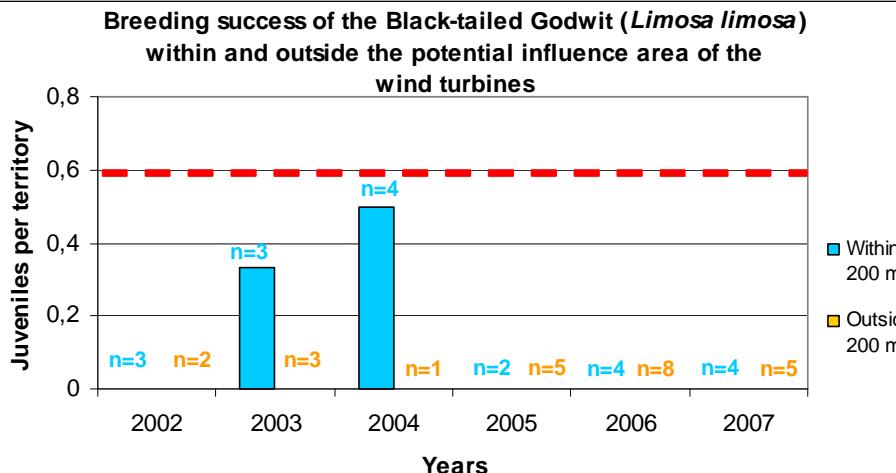
Results

Breeding success

Black-tailed Godwit (*Limosa limosa*)

Lapwing (*Vanellus vanellus*)

Breeding success 2002-2007



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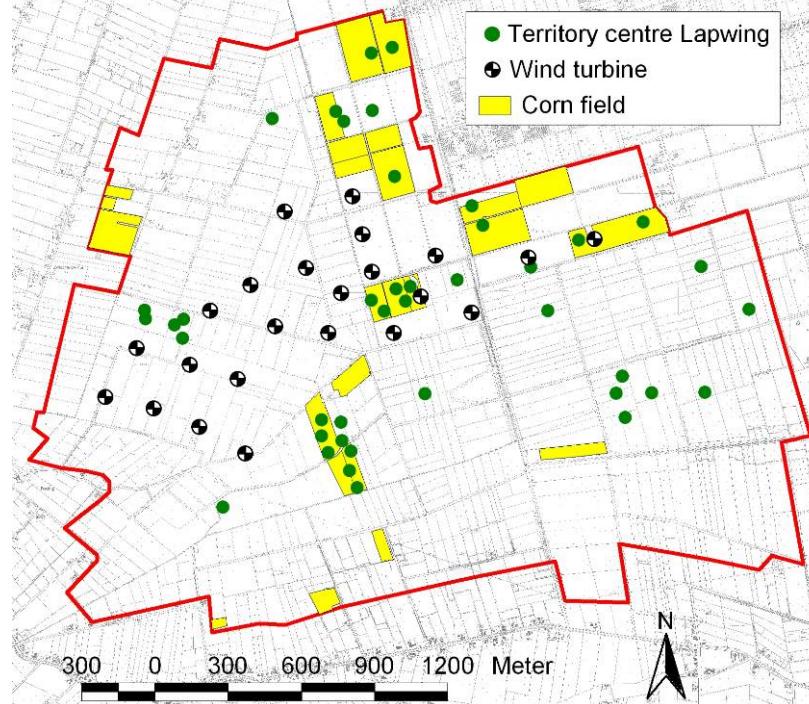
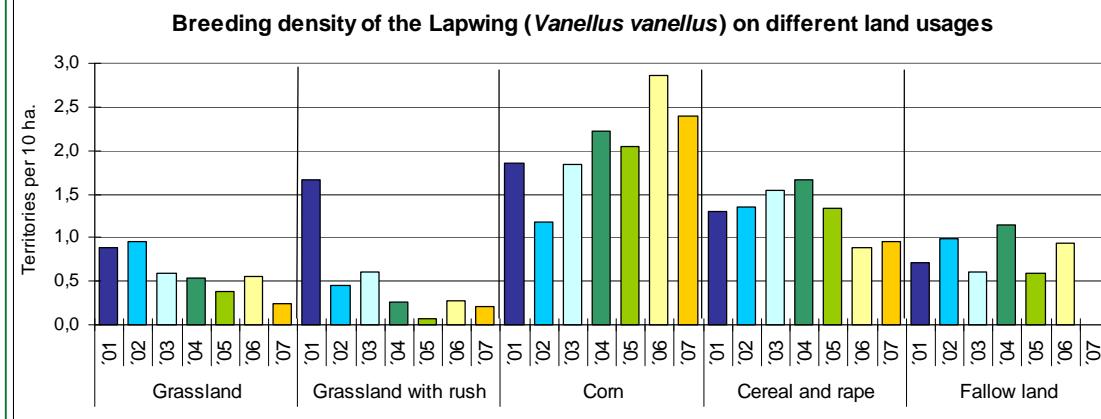
Results

Land usage

Lapwing Breeding birds



Breeding Lapwing: Preference for corn



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

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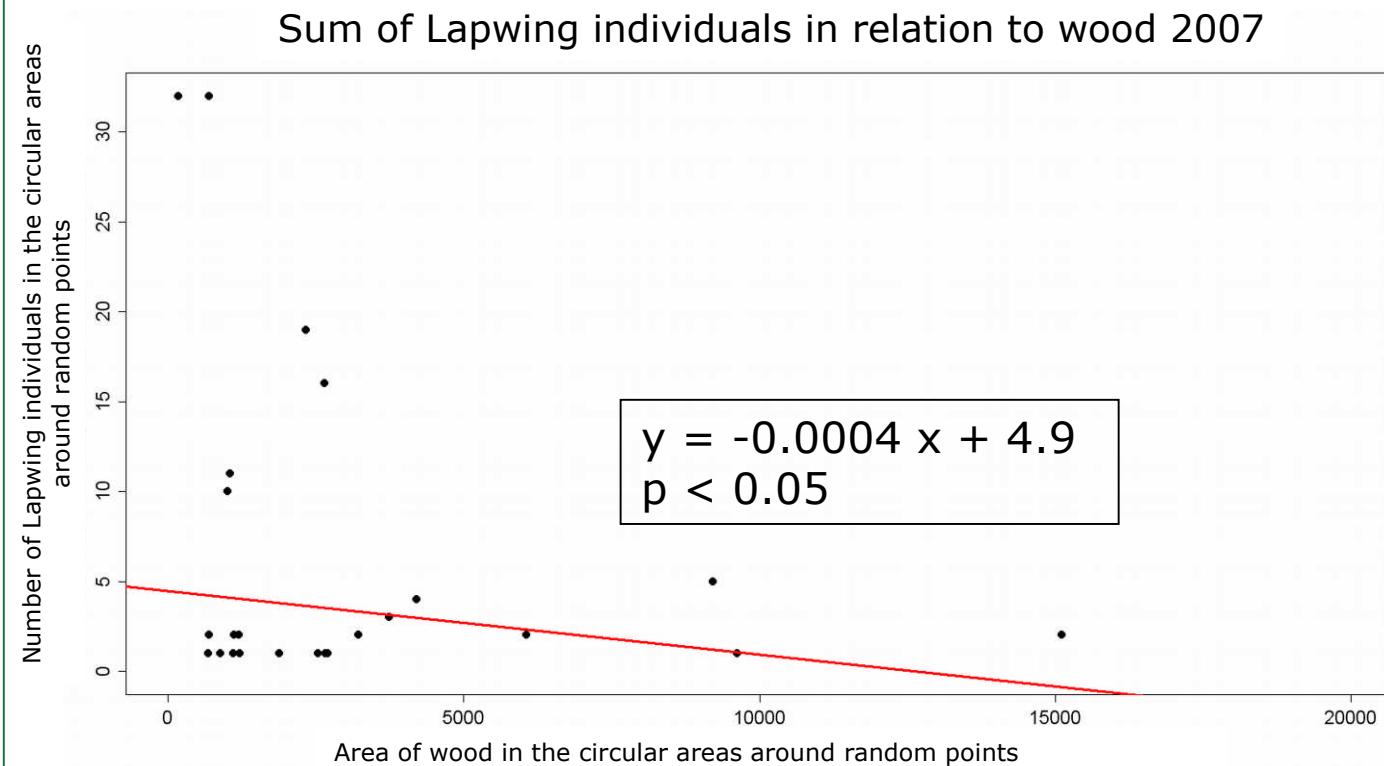
Results

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

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Results

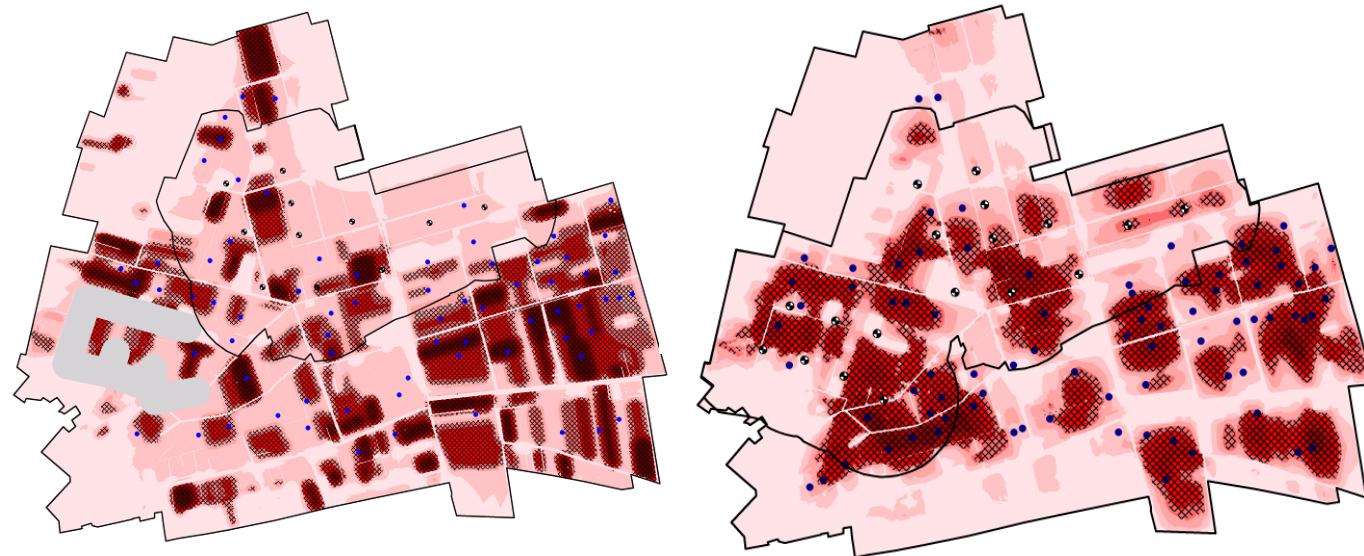
Habitat modelling

2003 - 2006

Skylark Breeding birds



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



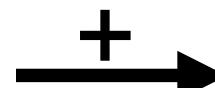
Density 2003:

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

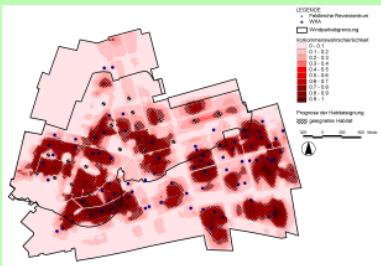


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Habitat modelling



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

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Literature review

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

Curlew
(*Numenius arquatus*)



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*)**



Photo: Daniel Pettersson

Windturbines and meadow birds in Germany

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

Conclusion

Photo: Daniel Pettersson



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The distribution of breeding birds around upland wind farms

James W. Pease-Higgins^a, Leigh Stephan^b, Steven H. W. Langston^c

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Summary

There is an urgent need for climate change mitigation, of which the generation of renewable energy, such as from wind farms, is an important component. Birds are expected to be sensitive to changes in their environment, and therefore may be used as indicators of environmental change. In the UK, we estimate that there is a reduced occurrence of breeding birds due to wind farms affecting the availability of nesting sites. We used a Before-After-Counterfactual (BACI) design to assess the effects of three interventions measuring their long-term effects on the distribution of breeding birds. 1. A 100 m exclusion zone around wind turbines; 2. A 100 m exclusion zone around wind turbines with a 100 m buffer; 3. A 100 m exclusion zone around wind turbines with a 1 km buffer.

1. A 100 m exclusion zone around wind turbines had a significant negative effect on the distribution of breeding birds.

2. A 100 m exclusion zone around wind turbines with a 100 m buffer had a significant negative effect on the distribution of breeding birds.

3. A 100 m exclusion zone around wind turbines with a 1 km buffer had no significant effect on the distribution of breeding birds.

- 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.



Photo: Andreas Trepte

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Thank you very much
for your attention!

Marc Reichenbach & Hanjo Steinborn

reichenbach@arsu.de

info@ecodata-steinborn.de

Black-tailed Godwit

