

Ecography

ECOG-01060

Hammers, M., Müskens, G. J. D. M., van Kats, R. J. M., Teunissen, W. A. and Kleijn, D. 2015. Ecological contrasts drive responses of wintering farmland birds to conservation management. – *Ecography* doi: 10.1111/ecog.01060

Supplementary material

1 Appendix 1

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3 SUPPLEMENTARY TABLES

Table A1. Overview of the three seed mixtures used to experimentally enhance food availability for farmland birds in the winters of 2011-2012 and 2012-2013. Mixtures were sown in April/May and left unharvested until the end of March next year. The mixtures differed between years, because species that failed to successfully establish in the first year were not used in the second year. Further, because of the dominance of fodder radish over wheat during the first year, the composition of the mixture containing both species was changed during the second year.

		% seeds in mixture	Seeding rate (kg/ha)
<i>2011-2012</i>			
Mixture 1			
Wheat (spring sown)	<i>Triticum aestivum</i>	50	46
Fodder radish	<i>Raphanus sativus</i>	50	10
Mixture 2			
Barley	<i>Hordeum vulgare</i>	30	30
Oilseed rape (spring sown)	<i>Brassica napus</i>	30	5
Buckwheat	<i>Fagopyrum esculentum</i>	30	17.5
Andive	<i>Cichorium endivia</i>	10	0.4
Mixture 3			
Triticale (spring sown)	<i>Triticale cereale</i>	30	30
Linseed	<i>Linum usitatissimum</i>	30	5
Sainfoin	<i>Onobrychis viciifolia</i>	4	1.5
Ribwort plantain	<i>Plantago lanceolata</i>	3	0.1
Quinoa	<i>Chenopodium quinoa</i>	30	1.7

Borage	<i>Borago officinalis</i>	3	1.2
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2012-2013

Mixture 1

Wheat (spring sown)	<i>Triticum aestivum</i>	80	75
Fodder radish	<i>Raphanus sativus</i>	20	4

Mixture 2

Barley	<i>Hordeum vulgare</i>	40	40
Oilseed rape (spring sown)	<i>Brassica napus</i>	20	3
Buckwheat	<i>Fagopyrum esculentum</i>	40	25

Mixture 3

Triticale (spring sown)	<i>Triticale cereale</i>	24	24
Linseed	<i>Linum usitatissimum</i>	23	4
Quinoa	<i>Chenopodium quinoa</i>	50	3
Borage	<i>Borago officinalis</i>	3	1.2

5 Table A2. Species list of the “non-farmland bird group”. This group consisted of species that
6 are not farmland specialists and/or species that do not have seeds as primary food source in
7 winter, but are encountered regularly in farmland (i.e. more generalist species). This list
8 excludes raptors and species not normally encountered in farmland.

Gray Heron	<i>Ardea cinerea</i>
Wood Lark	<i>Lullula arborea</i>
Eurasian Magpie	<i>Pica pica</i>
Ring-necked Pheasant	<i>Phasianus colchicus</i>
Twite	<i>Carduelis flavirostris</i>
Eurasian Bullfinch	<i>Pyrrhula pyrrhula</i>
Meadow Pipit	<i>Anthus pratensis</i>
Graylag Goose	<i>Anser anser</i>
Green Woodpecker	<i>Picus viridis</i>
Great Spotted Woodpecker	<i>Dendrocopos major</i>
Canada Goose	<i>Branta canadensis</i>
Mistle Thrush	<i>Turdus viscivorus</i>
Great Egret	<i>Ardea alba</i>
Duncock	<i>Prunella modularis</i>
Stock Dove	<i>Columba oenas</i>
Common Wood-Pigeon	<i>Columba palumbus</i>
House Sparrow	<i>Passer domesticus</i>
Eurasian Jackdaw	<i>Corvus monedula</i>
Brambling	<i>Fringilla montifringilla</i>
Northern Lapwing	<i>Vanellus vanellus</i>
Northern Shrike	<i>Lanius excubitor</i>
Black-headed Gull	<i>Chroicocephalus ridibundus</i>
Greater White-fronted Goose	<i>Anser albifrons</i>
Great Tit	<i>Parus major</i>

Redwing	<i>Turdus iliacus</i>
Common Crane	<i>Grus grus</i>
Fieldfare	<i>Turdus pilaris</i>
Eurasian Blackbird	<i>Turdus merula</i>
Egyptian Goose	<i>Alopochen aegyptiaca</i>
Eurasian Blue Tit	<i>Cyanistes caeruleus</i>
Rook	<i>Corvus frugilegus</i>
European Robin	<i>Erithacus rubecula</i>
European Stonechat	<i>Saxicola rubicola</i>
Eurasian Siskin	<i>Spinus spinus</i>
European Starling	<i>Sturnus vulgaris</i>
Long-tailed Tit	<i>Aegithalos caudatus</i>
Mew Gull	<i>Larus canus</i>
Horned Lark	<i>Eremophila alpestris</i>
Tundra Bean-Goose	<i>Anser serrirostris</i>
Eurasian Collared-Dove	<i>Streptopelia decaocto</i>
Water Pipit	<i>Anthus spinoletta</i>
Common Snipe	<i>Gallinago gallinago</i>
Mallard	<i>Anas platyrhynchos</i>
Eurasian Wren	<i>Troglodytes troglodytes</i>
White Wagtail	<i>Motacilla alba</i>
Eurasian Curlew	<i>Numenius arquata</i>

Table A3. A summary of the cover of different land-use types in control and food plot areas and the average seed density per land-use type used to calculate initial food availability per study area. Sampling effort of seed density focussed on potentially high seed density crops such as wildlife seed mixtures and unharvested crops.

	Mean cover (ha/study area)				Seed density (g/m ²)			
	2011-2012		2012-2013		Above-ground	<i>n</i>	ground-level	<i>n</i>
	Food plot	Control	Food plot	Control				
<i>Land-use types assumed to provide farmland bird food</i>								
Wildlife seed mixture	0.07	0.11	0.05	0.40	34.23	6	54.88	5
Vegetables/Vineyard	4.09	1.71	2.49	0.48	0.00	-	0.59	9
Fodder radish	1.83	0.86	1.05	0.67	52.48	25	6.17	26
Buckwheat	0.41	0.00	0.26	0.00	34.10	2	2.22	2
Barley	1.23	0.39	0.80	0.77	100.48	17	10.81	22
Cereal stubble†	0.44	3.80	0.94	0.42	3.68	10	0.23	1
Grass	22.56	35.92	21.08	33.67	0.08	1	0.00	-
Oats	0.86	0.00	1.70	0.45	21.76	13	10.45	17
Sown cereals‡	9.73	10.29	15.24	9.28	1.92	3	5.92	15
Bare soil‡	15.76	12.46	17.93	18.86	1.92	3	4.18	24
Linseed	0.05	0.00	0.00	0.00	72.20	3	41.84	5
Lucerne	2.00	0.40	2.12	0.48	0.00	-	6.33	4
Maize stubble‡	9.10	9.20	6.69	9.80	1.92	3	3.91	31
Extensive grassland†	3.64	1.37	2.54	0.35	3.68	10	0.00	-
Ruderal habitats	1.97	0.40	1.24	0.12	3.68	10	10.74	8
Wheat	1.32	1.53	2.51	1.97	195.20	16	29.08	23
Triticale/Rye/Spelt	0.33	0.66	1.01	0.07	33.94	5	6.01	5
<i>Land use types assumed not to provide farmland bird food</i>								
Pool	0.17	0.32	0.17	0.31	0		0	
Garden	0.20	0.19	0.20	0.30	0		0	

Cover crop	7.83	9.43	4.92	9.79	0	0
Buildings	2.09	2.78	2.09	2.78	0	0
Infrastructure	2.92	3.25	3.08	3.07	0	0
Forest/Orchards	7.46	5.79	7.98	6.49	0	0

* Above-ground seed availability assumed to be the same as for ruderal habitats.

† Above-ground seed availability assumed to be the same as for sown cereals

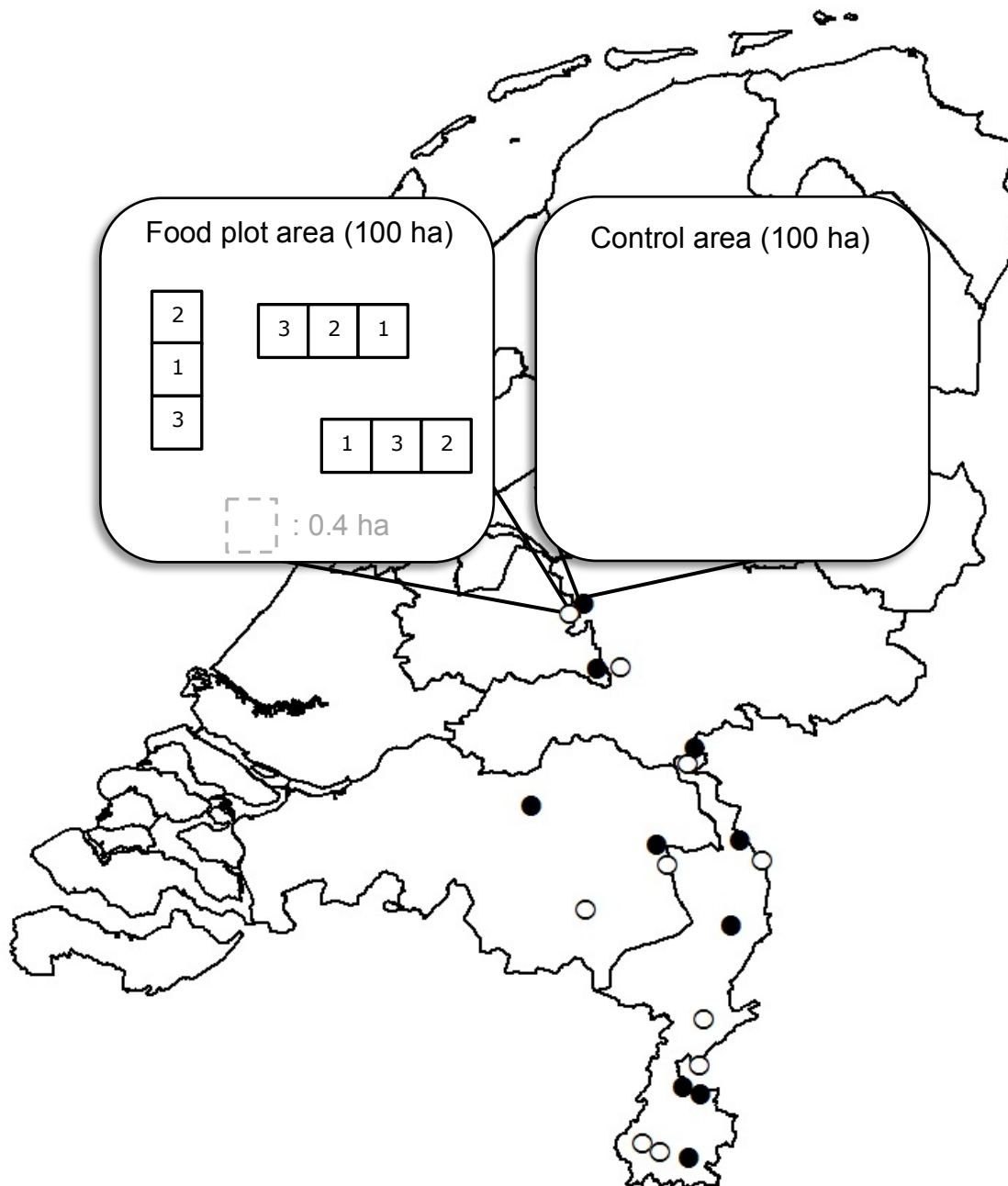
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13 SUPPLEMENTARY FIGURES

14 Figure A1. The locations of the twenty study areas in the Netherlands. Open circles indicate
15 food plot areas; filled circles indicate control areas.

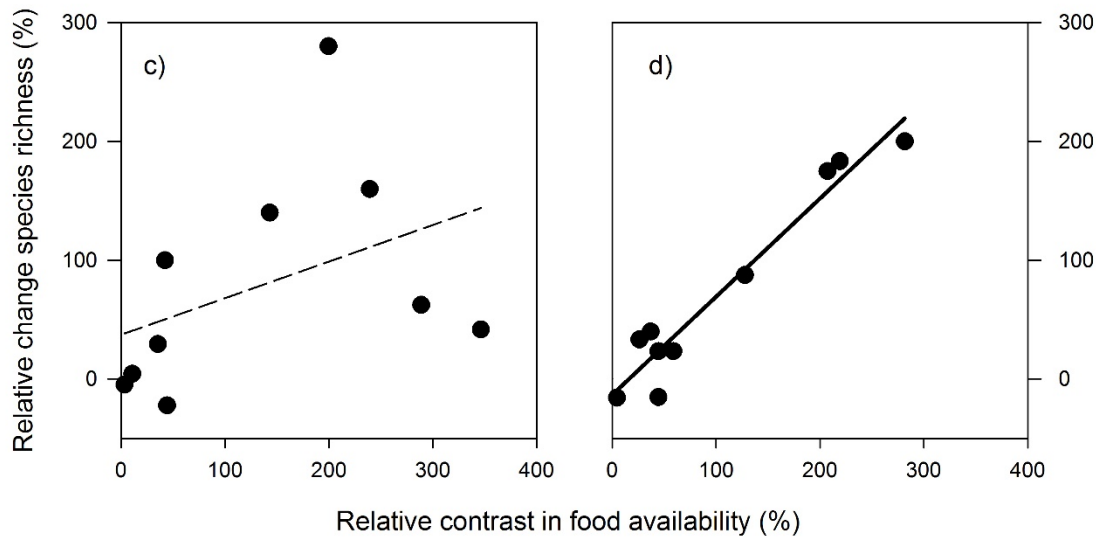
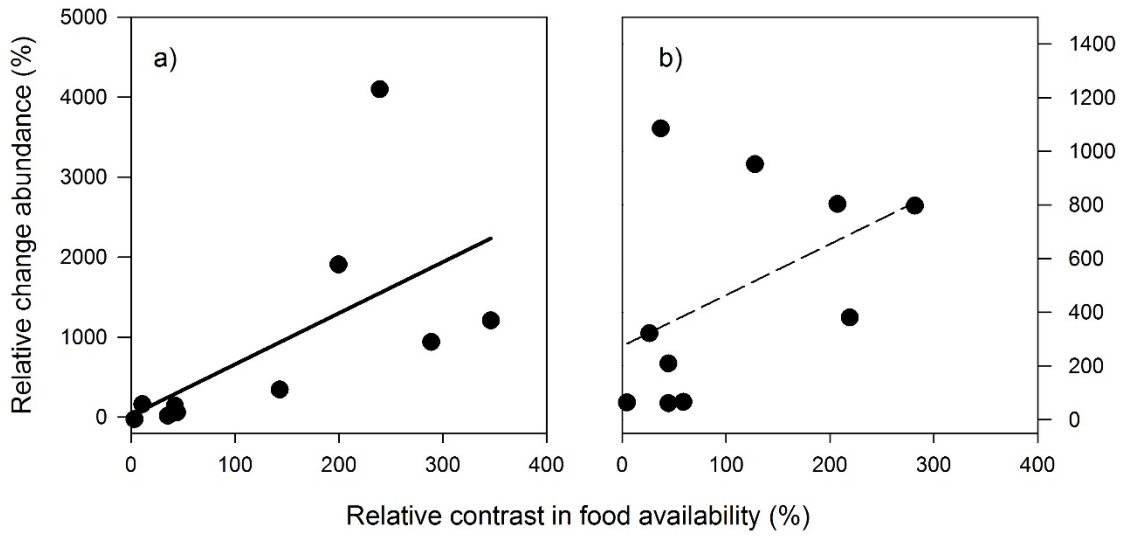
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17 Figure A2

18 The relationship between the relative difference in farmland bird abundance and species
19 richness and the relative contrast in food availability for the control and treatment paired areas
20 in both winters. a) is abundance in winter 2011-2012, b) is abundance in winter 2012-2013, c)
21 is species richness in winter 2011-2012 and d) is species richness in winter 2012-2013. Solid
22 lines represent significant regression slopes, the dashed lines represent non-significant trends.

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