Supported tetfund

RELATIONSHIP BETWEEN COMMUNITIES OF BIRDS AND INDICES OF HUMAN ACTIVITIES IN THE FEDERAL UNIVERSITY OF AGRICULTURE ABEOKUTA NATURE RESERVE

***[1]Yisau, M.A., [1]Onadeko, S.A., [2]Ijose, O.A. [1]Jayeola, A.O. [3]Ademolu, K.O., [1]Osunsina, I.O.O**

[1]Department of Forestry and Wildlife Management, Federal University of Agriculture, Abeokuta, Nigeria
[3]Department of Hospitality and Tourism Management, University of North Texas, USA
[3]Department of Pure and Applied Zoology Federal University of Agriculture, Abeokuta, Nigeria
*Corresponding author: yisauma@funnab.edu.ng

Received: February 11, 2023 **Accepted:** April 15, 2023

Abstract

Study on the relationship between communities of birds and human activities in the Federal University of Agriculture Abeokuta Nature Reserve were necessary because of dearth of information. Transects sampling method was used to survey birds in the reserve along eight transects of 1km each. All birds detected and sighted within 30meter radius from the point count stations were recorded for period of two years from October, 2013 to September, 2014 and from October, 2014 to September, 2015. The results showed a total population of 1,203 birds. There was reduction in the bird population, species richness, and Simpson's index of diversity, evenness, families and orders of bird encountered during the second year. Cultivated lands significantly influenced bird population and bird species richness; F (1, 6) = 6.269, p = 0.046 and F (1, 6) = 7.364, p = 0.035. It was that farming within the reserve negatively influenced population and species of birds in the reserve. Based on conservation implication, it is recommended that more efforts should be applied by the University management to protect and conserve the reserve.

Keywords: Birds, farming, logging, human activities, reserve

Introduction

Birds are undoubtedly most sensitive creature to changes in ecosystem and from ecological views, habitats become very essential to the survival of fauna living in them. This probably enhances birds as good ecological indicator to determine state of the environment (Gregory *et al.,* 2004b). Birds unlike other vertebrates show a remarkably consistent basic life cycle (Bennett and Owens, 2002). Besides, there is also great variability between some closely related species (Martin, 2004) and vegetation is of significant importance to birds because of bird usage of the various parts of vegetation at different level of heights for purposes like nesting, feeding, roosting, perching and breeding. More so, plants in any given habitat provide more specific microhabitats and shelter for birds (Fernandez *et al.*, 2004) while the forms and figure of vegetation is of great importance in distribution of birds therefore, vegetation density and coverage (structure) and species of plants provide clarification for dispersal of bird species and species richness (Parson *et al.*, 2003).

Studies on factors influencing bird species provide valuable information as discovered by Park and Lee (2000) that species richness in forest habitats is positively influenced by type of area for nesting, size of the area, foraging sites and migration traits. Seddon *et al.*, (2003) suggested that larger patches of habitat are capable of providing more resources to support more individual species. Many bird species required large areas of original habitat for survival but secondary forests are also important for many species that occur close to old-growth forests (Dent and Wright, 2009). Extent of tree-cover in landscape showed correlation with individual bird species abundance within patches and woodland avian species richness (Lindenmayer *et al.*, 2010). Augenfeld *et al.,* (2008) confirmed that vegetation structure in different bird environment regularly affects distribution of birds' communities, their richness, abundance and diversity. Joshi*et al.,* (2012) established positive correlation of avian species richness and diversity with foliage height diversity and plant species diversity. Foliage height, habitat connectivity, vegetation cover and habitat heterogeneity have influence on avian diversity and abundance (Gabbe *et al.*, 2002).

Several human factors such as deforestation, agriculture and urbanisation greatly affect bird composition and distribution in any habitat. Various land use practices such as deforestation and agriculture continues to change large expanse of vegetation covered areas annually and has impacts on biodiversity (Sala *et al.,* 2000). Agricultural development has changed vast areas into homogeneous agricultural land to enhance food productivity for growing populace. Habitat heterogeneity which is an important factor in sustaining biodiversity because it holds diverse landscapes that usually sustain more biodiversity and efficient ecosystem services is difficult to attain in the area of intense agricultural practices compared to homogeneous habitats (Winqvist *et al.*, 2011).

Influence of agricultural practices has been linked to bird species loss and this was emphasized by Johnson and Igi (2001) that declines in species and available habitats largely attributed to changes in agricultural practices while Egwumah *et al.,* (2009) linked decrease in species to habitat degradation, habitat loss and habitat fragmentation through agriculture. Expansion in agriculture leads to conversion and degradation of more ecosystems (Kareiva *et al.,* 2007). Further, it was observed that agriculture erodes native ecosystem (Tilman *et al.,* 2001). Evans *et al.,* (2006)

stated that high grazing heaviness in a habitat affect avian reproduction through modification of vegetation structure, landscape and destruction of birds' nests. However, it was discovered that grassland fragmentation causes harm to avian population (Batary and Baldi, 2004). In the light of these was lack of information on the relationship between the bird communities of Nature Reserve of Federal University of Agriculture Abeokuta and anthropogenic factors in the reserve. Hence the study aimed to determine the relationship between the communities of birds and human activities in the reserve.

Materials and Method

Study Area

This study was carried out in the Federal University of Agriculture, Abeokuta, latitude 7^0 13^1 N and 7^0 20^1 N and longitudes 3^0 20^1 E and 3^0 28^1 E. The University is on 10, 200 hectares out of which the Nature Reserve (NR) was established by the Institute of Food Security, Environmental Resources and Agricultural Research (IFSERAR). The Reserve totalled 300 hectares was carved out in 2011 (Institute of Food Security, Environmental Resources & Agricultural Research-IFSERAR, 2014) as part of efforts to conserve renewable natural resources. It shares boundary with the University 2,000 hectares research farm (IFSERAR, 2014). It partly drained by Ogun River in the north. The vegetation of the reserve is characterised by riparian, grassland, savannah and forest fragments while activities of human such as farming, logging, cattle herding and hunting are still noticeable within it.

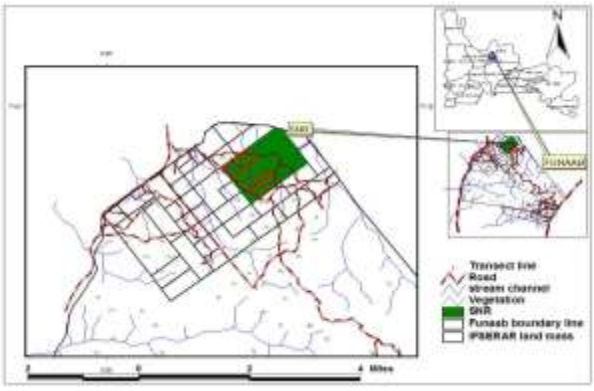

Figure 1 Nature Reserve in the Federal University of Agriculture, Abeokuta

Data Collection

Transects sampling method was used to survey birds in the reserve (Gregory *et al.*, 2004b). Eight transects of 1km each and of 200 meters interval to one another were established in the reserve on the base line of 1.6km. On each transect, 10 point count stations of 100 meters interval were identified and marked for observation of birds for 10minutes per point using direct observation and with aid of 8 x 40 Olympus binocular. All birds detected and sighted within 30meter radius from the point count station were recorded but excluding bird flying over the point areas. In order to account for the most active period of the birds and to identify any temporal niche carved by the birds in the study area, the bird observation was carried out in from 7am-9am and 4:30pm-6:30pm. The observation was carried out in 80 point count stations and a point count was visited twice in a year for to account for seasonal population, variation and migration among the bird assemblage of the reserve.

The survey lasted two years; First year bird survey was between October, 2013 and September 2014 while the second year bird survey was carried out between October, 2014 and September 2015. Various human activities such as cattle grazing, farming, logging activities were recorded during the bird surveying exercise in the reserve. Grazing regime was accounted for by the number of times the animals are present on the field, type of grazing animals, and the number of livestock-units per hectare per year (Bibby *et al.,* 2000). Index of logging activities used was total number of stumps recorded per transect. Farming was accounted for by counting the population of the farm plots along each transect and within the bandwidth of each point count station. Bird data were subjected to descriptive using Statistical Package for Social Science- SPSS version 21 and Simpson's diversity index analysis using EstimateS software while step-wise regression analysis was used to elicit the relationship between the assemblage of birds in the reserve and the indices of human activities.

Results and Discussion

Total population of bird was 1,203 out of which 606 were encountered during the first year and 597 during the second year. Bronze manikin (76) had the highest population with mean value of 19.0 ± 1.0 followed by Vieillot's black Weavers (64) with mean value 16.0±5.0. African wood owl (1), Northern Red-bishop (2) and Night heron (2) are the bird species that were rarely encountered in the reserve during the first year. Highest population species was Vieillot's black weavers (115) with mean value 29.0±4.0 followed by Bronze manikin (73) with mean value 18.0±3.0 and Cattle egret (58) with mean value 29.0±2.0 during the second year. Africa darter (1), Red-billed fire finch (1), Red-billed helmet-shrike (1), Sulphur-breasted bush-shrike (2), Blue-billed malimbe (2) and Black crake (2) were not common (Table 1).

Total bird species richness found in the first and second year was 47 and 39 species respectively. EstimateS true species richness estimators for the reserve tallied with the species richness observed in the first year while it was marginally different in the second year. Simpson's index of diversity was 0.95 and 0.91 respectively while there was high species evenness with index values of 0.44 during the first year than during the second year, 0.28. The families of bird recorded during the first and the second year was 33 and 26 respectively while 12 and 11 bird orders were found in the year respectively (Table 2). Species richness and population of birds found in this study was less than and contrary to 81 bird species in the previous study by (Jayeola, Onadeko and Ola-Adams, 2000) in the University. The decrease could be attributed to increase in farming activities within the reserve. The relationship

between assemblage of birds and farming activities in the reserve was in consonant with (Laurance *et al.,* 2002) that farming contributes to decline of birds in the tropical forest.

Likewise, birds species richness discovered in this study were less than and contrary to 80 species of birds discovered by Jayeola (2004). This could be ascribed to the abrupt reduction in the forest area in the University from 51% forest areas as at the year 2002 (Assaf, 2002) to 0.05% as at the year 2016 (Oyedepo, *et al.,* 2016). The result of the species richness also compared to 67 species found by (Onadeko *et al.,* 2002) and it showed that 21% of the species were no longer detectable easily or extinct locally in the University.

Results revealed that there was significant relationship between population of birds and the cultivated lands in the reserve during the first year; F (1, 6) = 6.269, p = 0.046. Coefficient of determination R^2 was 0.51 and it indicated that cultivated lands accounted for 51% of the variation in birds populations found in the reserve during the period. The coefficient value of the relationship was -0.825, a negative linear relationship between the population of birds and the cultivated lands in the study area. Correlation coefficient value was 0.72 and it meant that there was association between the observed and predicted values of dependent variable. Equally during the first year, there was significant relationship between bird species richness and the cultivated land in the reserve, F (1, 6) = 7.364, p = 0.035.

The relationship between the two variables was a linear negative because the coefficient value of the relationship was -0.643. Coefficient of determination R^2 was 0.55 and it showed that 55% of the variance in bird species richness was explained by cultivated lands in the reserve during the period. Correlation coefficient value was 0.74 and it inferred that there was a positive association between the observed and predicted values of dependent variable.

During the second year there was also significant relationship between birds populations and cultivated lands; F (1, 6) = 7.181, p = 0.037. R^2value was 0.54 and it revealed that cultivated land accounted for 54% of the variance in the bird species richness during the year. The relationship was a negative linear because the coefficient value of the relationship was-0.738. Correlation coefficient value was 0.73 and it meant there was a positive association between the observed and predicted values of dependent variable. Also, there was no significant relationship between birds species richness and indices of human activities; F (4, 3) = 7.097, p = 0.977 (Table 3).

The community of birds during the first and the second year responded negatively to the farming activities on the cultivated landscape in the reserve and it showed that the more the population of cultivated landscape in the reserve the less the population of birds encountered. This was evident in the decreased of species and bird population from first year to the second year of the study. Faming activities in the reserve pose challenge to the community of birds through destruction of habitats useful for birds and this corroborates (Sekercioglu, 2002) findings that reduction in population of forest dependent bird species is linked to vegetation removal for agriculture. It was further in agreement with (Sala *et al.,* 2000) that agriculture continues to change large expanse of vegetation covered areas along with their biodiversity.

Conclusion

The study concluded that cultivated landscape in the reserve had negative influence on the communities of birds in the reserve. Considering the conservation implication and effect that the population of cultivated lands had on the abundance of bird and species richness in the reserve, it is recommended that more pragmatic efforts should be applied by the University management to preserve the reserve.

Table 1 Populations and species of birds encountered in the first and second year

		First Year		Second Year	
Species	**Scientific Name**		**Mean ± SE**		**Mean ± SE**
Africa darter	*Anhinga rufa*	-	-	1	1±0
African Piping hornbill	*Bycanistes fistulator*	10	5±1.0	11	3±0
African Palm swift	*Cypsiurus parvus*	18	8±2.0	6	3±1.0
African Pied Hornbill	*Tockus fasciatus*	7	4±1.0	7	2±0
African Pied wagtail	*Motacilla aguimp*	8	4±1.0	14	5±1.0
African Thrush	*Turdus pelios*	15	4±1	16	4±1.0
African wood owl	*Strix woodfordii*	1	-	-	-

Bar-breasted firefinch	*Lagonosticta rufopicta*	9	4±1.0	2	2±0
Blue-headed coucal	*Centropus monachus*	7	3±1.0	4	2±0
Black crake	*Amaurornis flavirostra*	3	2±1.0	2	1±0
Black kite	*Milvus migrans*	10	5±1.0	8	4±0
Black shouldered kite	*Elanus caeruleus*	9	2±1.0	6	2±1.0
Black-crowned night heron	*Nycticorax nycticorax*	5	2±1.0	5	2±1.0
Blue-billed malimbe	*Malimbe nitens*	3	2±1.0	2	2±0
Bronze mannikin	*Spermestes cucullata*	76	19±1.0	73	18±3.0
Cattle egret	*Bubulcus ibis*	42	11±2.0	58	29±2.0
Common Bulbul	*Pycnonotus barbatus*	29	7±1.0	28	9±1.0
Common Nightingale	*Luscinia megarhynchos*	4	2±1.0	-	-
Double-spurred francolin	*Francolinus bicalcaratus*	17	4±1.0	19	6±1.0
Garden warbler	*Sylvia borin*	9	4±1.0	16	4±0
Grey heron	*Ardea cinera*	3	2±1.0	-	-
Grey wood pecker	*Dendropicos goertae*	5	1±1.0	-	-
Grey-headed kingfisher	*Halcyon leucocephala*	11	5±1.0	10	3±1.0
Harrier Hawk	*Polyboroides typus*	3	2±0	3	2±0
Laughing dove	*Streptopelia senegalensis*	9	5±1.0	-	-
Lead-coloured flycatcher	*Myiopparus plumbeus*	20	5±0	10	5±1.0
Little Bee-eater	*Merops pusillus*	20	5±1.0	9	6±1.0
Lizard buzzard	*Kaupifalco monogrammicus*	7	3±1.0	3	1±0
Malachite kingfisher	*Alcedo cristata*	7	4±1.0	12	3±1.0
Northern grey-headed sparrow	*Passer griseus*	13	4±1.0	-	-
Northern Red bishop	*Euplectes franciscanus*	2	1±0	-	-
Orange cheeked waxbill	*Estrilda melpoda*	9	4±1.0	15	4±1.0
Pied crow	*Corvus albus*	6	3±0	10	6±1.0
Pied kingfisher	*Ceryle rudis*	3	2±1.0	-	-
Pin-tailed whydah	*Vidua macroura*	7	4±1.0	3	1±0
Red-billed fire finch	*Lagonosticta senegala*	6	2±0	3	2±1.0
Red-billed helmet-shrike	*Prionops caniceps*	-	-	2	1±1.0

Scarlet chested Sunbird	*Chalcomitra senegalensis*	3	2±0	-	-
Senegal coucal	*Centropus senegalensis*	11	5±1.0	15	4±1.0
Splendid glossy starling	*Lamprotornis splendidusi*	17	5±1.0	13	4±2.0
Splendid sunbird	*Cinnyris coccinigastrus*	17	4±1.0	25	6±2.0
Sulphur-breasted bush-shrike	*Malaconotus sulfureopectus*	3	2±1.0	1	1±0
Vieillot's black weavers	*Ploceus nigerrimus*	64	16±5.0	115	29±4.0
Village weavers	*Ploceus cucullatus*	48	12±2.0	33	8±2.0
Vinaceous dove	*Streptopelia vinacea*	18	9±1.0	13	3±1.0
Western Grey Plantain-eater	*Crinifer piscator*	10	4±1.0	11	3±0
Yellow-billed barbet	*Trachylaemus purpuratus*	3	2±0	5	3±1.0
Yellow-mantled widowbird	*Euplectes macroura*	4	2±0	8	2±1.0

Table 2 First and second year birds heterogeneity in the SNR

Index	First Year	Second Year
Observed Richness (S)	47	39
Abundance-Based Coverage Estimated (ACE)	48	40
Simpson's Reciprocal Index (1/D)	20	11
Simpson's Index of Diversity (1-(1/D)	0.95	0.91
Species Evenness E- (1/D)/S	0.44	0.28
Family	33	26
Order	12	11
Bird Population	606	597

Table 3 Relationship between assemblages of birds and indices of human activities found during the first and the second year in the reserve

Year	Site	Dependent Variables	*F*(df)	Sig.	Coefficient	R	R^2 (%)
1	SNR	Bird population	F (1, 6) = 6.269	p = 0.046	-0.825	0.72	51
		Species Richness	F (1, 6) = 7.364	p = 0.035	-0.643	0.74	55
2	SNR	Bird population	F (1, 6) = 7.181	p =0 .037	-0.738	0.73	54
		Species Richness	F (4, 3) = 7.097	p =0 .977	-	-	-

*Significant at 5% ($p<0.05$)

References

Assaf, I. K. (2002). Impacts of Land Use on diversity of plants in the University of Agriculture Abeokuta Permanent site. Unpublished Master Dissertation in Environmental Management & Protection, Department of Environmental Management & Toxicology, University of Agriculture, Abeokuta, 93pp.

Augenfeld, K.H., Franklin, S.B. andSnyder, D.H. (2008). Breeding bird communities of upland hardwood forest 12 years after shelterwood logging. *Forest Ecology &Management*255 (3-4): 1271-1282.

Batáry, P. A. and Báldi, A. (2004). Evidence of an edge effect on avian nest success: a meta-analysis. *Conservation Biology* 18 (2): 389-400

Bennett, P. M. and Owens, I. P. F. (2002). *Evolutionary Ecology of Birds: Life histories, Mating systems & Extinction*. Oxford: Oxford University Press.296pp.

Bibby, J. C., Burgess, D. N., Hill, A. D and Mustoe, S. (2000). *Bird Census Techniques*. Second Edition, Academic Press. 302pp.

Dent, D. H. and Wright, J. S. (2009). The future of tropical species in secondary forests: a quantitative review. *Biological Conservation* 142 (12):2833-2843.

Egwumah, P.O., Umoren, D.I. and Ita, G.S. (2009). "Bird's Species Sensitivity in a Fragmented Landscape of IkoEsai Community Forest Reserve of Cross River State", *Biological & Environmental Science Journal for the Tropics*, 6 (1):11 – 15.

Evans, D. M., Redpath, S. M., Evans, S. A., Elston, D. A., Gardner, C. J., Dennis, P. and Pakeman, R. (2006). Low intensity, mixed livestock grazing improves the breeding abundance of a common insectivorous passerine. *Biology Letters* 2 (4): 636–638

Fernandez, G. J., Posse, G., Ferretti, V. and Gabelli, F. M. (2004). Bird-habitat relationship for the declining Pampas meadowlark populations in the southern Pampas grasslands. *Biological Conservation* 115(1):139-148.

Gabbe, A. P., Robinson, S. K. and Brawn, J. D. (2002). Tree-species preferences of foraging insectivorous birds: implications for floodplain forest restoration. *Conservation Biology* 16 (2): 462-470.

Gregory, R. D., Gibbons, D. W. and Donald, P. F. (2004b). Bird census & survey techniques. In: *Bird ecology & conservation*; a *Handbook of Techniques*, ed. Surtheland, W. J., Newton, I, & Green, R. E. Oxford, Oxford University Press, 17-22pp.

Institute of Food Security, Environmental Resources & Agricultural Research -IFSERAR (2014). *Annual Report*. http://ifserar.unaab.edu.ng Accessed on April 18, 2015

Jayeola, O. A., Onadeko, S. A. and Ola-Adams, B. A. (2000). Gradient distribution & abundance of wildlife vertebrates in a secondary rainforest ecosystem.*Nigeria Journal of Forestry 39(1): 36-46.*

Jayeola, O. A. (2004). Distribution & diversity of wildlife species in University of Agriculture Abeokuta. Unpublished Master Dissertation in Wildlife Ecology &Management, Department of Forestry & Wildlife Management, University of Agriculture, Abeokuta, 88pp.

Johnson, D. H. and Igl, L. D. (2001). "Area Requirements of Grassland Birds: A regional perspective", *Auk* 118 (1): 244 – 34.

Joshi, K. K., Bhatt, D. and Thapliyal, A. (2012). Avian diversity & its association with vegetation structure in different elevational zones of Nainital district (Western Himalayan) of Uttarakhand. *Journal of Biodiversity & Conservation* 4 (11): 364- 376.

Kareiva, P., Watts, S., Mcdonald, R. and Boucher, T. (2007). Domesticated nature: shaping landscapes & ecosystems for human welfare. *Science* 316 (5833): 1866-1869.

Laurance, W. F., Lovejoy, T. E., Vasconcelos, H. L., Bruna, E. M. R., Didham, K., Stouffer, P. C., Gascon, C., Bierregaard, R. O., Laurance, S. G. and Sampaio, E. (2002). Ecosystem decay of Amazonianforest fragments: a 22-year investigation. *Conservation Biology* 16 (3), 605-618.

Lindenmayer, D. B., Knight, E. J., Crane, M. J., Montague-Drake, R., Michael, D. R. and Macgregor, C. I. (2010). What makes an effective restoration planting for woodland birds? *Biological Conservation*, 143 (2): 289 – 301.

Martin, T. E. (2004). Avian life-history evolution has an eminent past: Does it have a bright future? *Auk*, 121(2), 289-301.

Park, C. R. and Lee, W. S. (2000). Relationship between species composition &area in breeding birds of urban woods in Seoul, Korea. *Landscape &UrbanPlanning* 51(1) 29-36.

Parsons, H., French, K., and Major, R. E. (2003). The influence of remnant bushland on the composition of suburban bird assemblages in Australia. *Landscape & Urban Planning* 66 (1): 43-56.

Sala, O. E., Chapin, F. S., Armesto, J. J., Berlow, E., Bloomfield, J., Dirzo, R., Huber-Sanwald, E., Huenneke, L. F., Jackson, R. B., Kinzig, A., Leemans, R., Lodge, D. M., Mooney, H. A., Oesterheld, M., Poff, N. L., Sykes, M. T., Walker, B. H., Walker, M. And Wall, D. H. (2000). Biodiversity - Global biodiversity scenarios for the year 2100. *Science*, 287 (5459): 1770-1774.

Seddon, J. A. Briggs, S. V. and Doyle, S. J.(2003). Relationships between bird species & characteristics of woodland & remnants in central

New South Wales. *Pacific Conservation Biology* 9 (2): 95 – 119

Tilman, D., Fargione, J., Wolff, B., D'antonio, C., Howarth, R., Schindler, D., Schlesinger, W.H., Simberloff, D. and Swackhamer, D. (2001). Forecasting agriculturally driven global environmental change. *Science* 292 (5515): 281-284.

Onadeko, S. A., Ojo, L. O., Jayeola, O. A. and Ogunjinmi, A. A. (2002). Response of Avian species to Environmental changes in a derived savannah in Abeokuta. *Nigeria Journal of Ecology* 4 *(1): 59-72*

Oyedepo, J. A., Oyatogun, M. O., Jayeola A. O. and Oladoye, O. (2016). GIS- supported survey of ecological biotopes within the Federal University of Agriculture Abeokuta campus, Ogun State, Nigeria. *Proceedings* of NTBA/NSCB Joint Biodiversity Conference, Unilorin.190-198pp.

Sekercioglu, C. H. (2002). Effects of forestry practices on vegetation structure & bird community of Kibale National Park, Uganda. *Biological Conservation* 107 (2): 229-240.

Winqvist, C., Bengtsson, J., Aavik, T., Berendse, F., Clement, L. W., Eggers, S., Fischer, C., Flohre, A., Geiger, F., Liira, J., Pärt, T., Thies, C., Tscharntke, T., Weisser, W. W. and Bommarco, R. (2011). Mixed effects of organic farming & landscape complexity on farmland biodiversity & biological control potential acrossEurope. *Journal of Applied Ecology* 48 (3): 570-579.