A comparison of the wintering bird communities of the re-wilded Knepp Castle Estate with adjacent farmland

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A comparison of the wintering bird communities of the re-wilded Knepp Castle Estate with adjacent farmland

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Abstract

Modern agriculture has had a huge impact on the environment over the last 50 years, resulting in dramatic declines in once familiar farmland birds. Until recently, wildlife conservation in Britain concentrated on the protection of nature reserves containing small areas of semi-natural habitat. As this approach is unsustainable, alternatives such as re-wilding are currently in vogue. One of the best known examples of a re-wilding project is the Knepp Castle Estate in West Sussex where the abandonment of traditional agriculture since 2001 and the introduction of herbivores such as deer and Tamworth pigs has produced spectacular results in terms of biodiversity. Trends in breeding birds on the Estate have been well studied, whereas wintering birds have received little attention.

Wintering bird surveys were carried out from four transects at Knepp and two on surrounding farmland. Of the 55 species recorded, 22 were either Red or Amber list birds of conservation concern. Most of these species can be considered ‘generalists’ rather than farmland ‘specialists’ such as skylark and yellowhammer which were recorded in very low numbers with no evidence of a shift from surrounding farmland onto the Estate itself. Other species such as fieldfare and redwing were recorded in larger numbers although there were differences in their distribution, both within the Estate and in comparison with off-site farmland controls.

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1. Introduction

It is widely recognised that modern agricultural practices have had a major detrimental impact on the countryside and its wildlife. Over the last half century, farming has become increasingly large scale and mechanised with a growing reliance on the use of synthetic fertilisers and pesticides to maximise crop yields (Newton 2017). Unfortunately, these changes have had a huge environmental impact with a massive loss of wildlife, especially farmland birds, despite agri-environmental schemes (AES) designed to reverse this downward trend. Evidence for this is provided by the UK farmland bird index which, in 2016, was less than half its 1970 value, with the steepest decline having occurred between the late 1970s and the 1980s, largely due to rapid changes in farmland management during this period (DEFRA 2017). The declines that occurred in the 1970s and 1980s hit 'specialist' farmland birds far harder than 'generalists' resulting in many, such as skylark *Alauda arvensis* and yellowhammer *Emberiza citrinella*, being listed as Red or Amber species of conservation concern (Gregory, Noble & Custance 2004).

The conservation of wildlife in Britain has until recently focused on the protection of nature reserves made up of small, special areas of semi-natural habitat. However, these special areas make up less than 2% of the overall land area in Britain, and offer little prospect of protecting viable populations of a wide range of species in the long term. If Sites of Scientific Interest (SSSIs) are included, another 9% of the land surface of Britain has some degree of protection though it is estimated that most of this land (7 of the 9%) is in a poor or deteriorating state. Thus only about 4% of the land surface of Britain is currently in a favourable condition for the benefit of wildlife (Newton 2017).

Recent years have seen a major growth in interest in the concept of re-wilding as an alternative and large-scale conservation strategy, based on dynamic processes (Taylor 2005). Re-wilding was originally pioneered at Oostvaardersplassen in the Netherlands by the Dutch ecologist Frans Vera based on his hypothesis that Europe, before the dawn of mankind, was not a closed forest but a wood pasture home to megafaunal herbivores that encouraged biodiversity (Vera 2000). The process of re-wilding should be seen as rather more than just ecological restoration and attempting to re-create the past; it has been defined by Primmer (2013) as "a method of restoring the increased functionality of ecosystems through the re-introduction of flora and fauna into areas where they may once have existed but are not currently present" and by Rewilding Britain (2018a) as "the large-scale restoration of ecosystems where nature can take care of itself by seeking to reinstate natural processes and, where appropriate, missing species – allowing them to shape the landscape and the habitats within." The benefits of re-wilding are numerous and include an increase in biodiversity, creating ecosystems which are more able to adapt to environmental change and are less dependent on people for continued inputs or management, and the potential to make land management more financially viable (Primmer 2013).

There are numerous examples of re-wilding projects throughout England, Wales and Scotland. One of the best known is the 1,400 hectare (3,500 acre) Knepp Castle Estate which lies a few miles to the south of Horsham, in West Sussex (see fig. 1). It is now the UK's largest lowland rewilding project and one of the largest in Europe (Rewilding Britain 2018b).

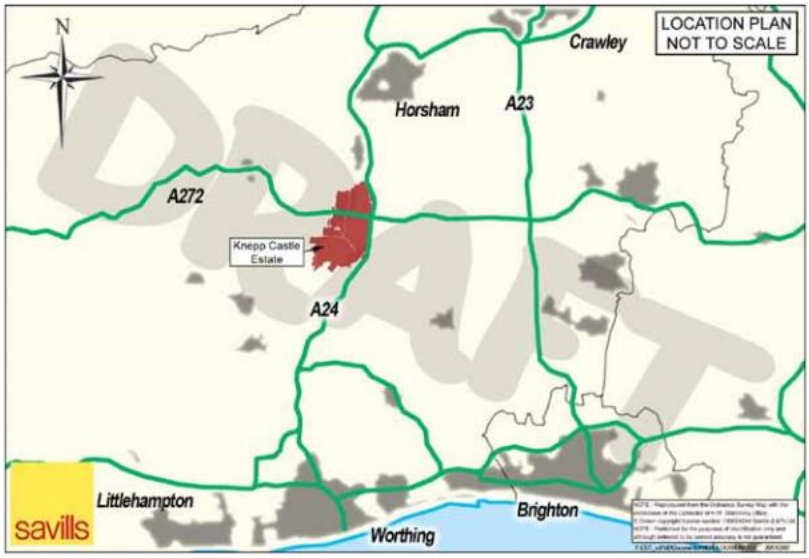

Fig 1. Location of Knepp Castle Estate (source: Kernon Countryside Consultants 2007)

The recent history of the Knepp Estate has been summarised by Marren (2016). Between World War 2 and 2001, Knepp was a conventional mixed farm but in most years it failed to make a profit due to its hard to cultivate, poor quality heavy Wealden clay soils. As well as meat and milk from cattle, it produced maize, rape, wheat and other crops. After 2001, the perimeter of the Estate was fenced and internal barriers removed. Intensive farming was abandoned in four phases and the Estate was allowed to re-wild with the support of Natural England through the Higher Level Stewardship (HLS) scheme. The inspiration for what has been called the Knepp Wildland project came from a visit by the Estate's owner (Sir Charles Burrell) to Oostvaardersplassen to see the pioneering work of Frans Vera. The first stage in the re-wilding process was to cease putting fertilisers on the land and also cease ploughing and intensive grazing by sheep and cattle. The dairy herd was sold and replaced by English Longhorn cattle and also Exmoor ponies, fallow deer *Dama dama* and Tamworth pigs, the latter thought to be the closest domestic breed to ancestral pigs. In 2009, red deer *Cervus elaphus* were also released. These large herbivores were introduced to replicate the post-Ice Age megafauna which would once have consisted of aurochs (the original wild ox), wild horses and wild

boar. As the Wildland project has progressed, each of the introduced herbivore species has had its own, unique influence on the vegetation and soil, driving habitat changes across the Estate and helping to create a mosaic of habitats including grassland, scrub and wood pasture. In the absence of natural predators such as lynx and wolf, the cattle are culled from time-to-time to prevent overgrazing and to provide a sustainable yield of organic pasture-fed meat, supplemented by venison from culled deer, helping to make the Estate profitable. Even though the Estate is still essentially a farm and not a nature reserve, the overall vision for the future is one where natural processes predominate and long-term financial stability is achieved outside a conventional agricultural framework (Kernon Countryside Consultants 2007).

Ecological surveys carried out on the Estate over the past 15 years since the commencement of the Wildland project have shown spectacular results in terms of biodiversity. Knepp has 13 of the UK's 17 species of bat including the rare barbastelle *Barbastella barbastellus* and Bechstein's bat *Myotis bechsteinni* (Marren 2016). It is also now the UK's premier site for the purple emperor butterfly *Apatura iris*. This species is a recent colonist of the blocks of sallow *Salix cinerea* which became established in the old fields as they were taken out of agriculture (Blencowe & Hulme 2017). A baseline breeding bird survey carried out in 2005 showed that the Estate supports a rich breeding bird community (Greenaway 2006) including a significant number of species of both medium conservation concern (Amber list) and high conservation concern (Red list) as identified by Eaton *et al.* (2015). Annual monitoring has shown increases in some of these species since 2005, including nightingale *Luscinia megarhynchos* and turtle dove *Streptopelia turtur*, both of which are red-listed and have a UK stronghold at Knepp. Research by Imperial College in 2012 into the effects of re-wilding on breeding bird performance at Knepp, found a total of 43 nightingale territories, comprising 34

territories on the Estate but only nine territories on neighbouring intensively managed farmland (Greenaway 2013).

Although the breeding bird community at Knepp has been the subject of numerous surveys and some research projects since 2005, its wintering bird community has until recently largely been ignored. In 2017 and again in early 2018, a small number of wintering bird surveys were carried out on the Estate by a team of volunteers (Penny Green *pers comm*). These were carried out within the southern block of the Estate (where most of the re-wilding has taken place) and revealed the presence of numbers of fieldfare *Turdus pilaris* and redwing *T. iliacus*, among other species. Both are red-listed species of high conservation concern although, in the absence of comparative data from surrounding farmland, it is unclear how significant their numbers actually are and whether the Estate supports higher numbers compared with nearby farmland.

The species composition and overall numbers of birds on farmland changes greatly between summer and winter. Summer visitors, such as warblers and nightingale, leave after breeding to winter elsewhere and are replaced by other species from higher latitudes which move in for the winter. Typical winter visitors from overseas include thrushes, such as fieldfare and redwing, waterfowl and waders, especially northern lapwing *Vanellus vanellus*, golden plover *Pluvialis apricaria* and Eurasian woodcock *Scolopax rusticola* (Newton 2017). Most species that forage on farmland in winter, including lapwing, golden plover, fieldfare and redwing, are gregarious, forming communal roosts at night and feeding in flocks by day, wherever food is plentiful at the time. However, the number of birds on individual farms in winter varies greatly depending on the resources available (Newton 2017). Except in harsh winters, farmland in the UK remains damp and unfrozen for most of the time allowing ground-feeding species such as lapwing, thrushes and common starling

Sturnus vulgaris access to soil-dwelling worms and invertebrates. Grass fields tend to be more used in winter than in summer, because in winter the grass is short, giving easy access for ground-feeding birds, along with all-round visibility to detect approaching predators (Newton 2017). Thrushes, including fieldfare and redwing, will also forage in hedgerows feeding on the berries of species such as hawthorn *Crataegus monogyna*.

In a 5-year study of bird populations on a large arable estate in central England (Redhead *et al.* 2018), significantly increased numbers of some farmland birds were found in areas where agri-environmental schemes (AES) had been implemented compared with off-site controls. These increases were linked to increased winter food resources in the AES areas. It seems probable therefore that the re-wilded areas of the Knepp Estate, where food resources are likely to be greater, will support larger numbers of wintering farmland birds compared with adjacent intensively managed farms. Further support for this theory is provided by research carried out by Imperial College at Knepp that found that song thrush *Turdus philomelos* had a high breeding density in the southern block of the Estate but was entirely absent from Prior's Byne Farm in nearby Partridge Green. An explanation for this is provided by unfavourable agricultural practices that have reduced the foraging resources for song thrush, the absence of which at Knepp may have helped promote key prey items on which song thrushes depend (Greenaway 2013). Given that fieldfare and redwing also belong to the thrush family (Turdidae), it might be expected that they too will be unable to find sufficient foraging resources on external farmland, especially in winters when the berry crop is poor, and will thus occur in larger numbers at Knepp.

This project aims to determine the species that make up the wintering bird communities within the re-wilded southern block at Knepp and to test the

hypothesis that the numbers of some farmland species will be greater than those for two off-site controls comprising areas of intensively managed farmland adjacent to Knepp at Jenden's Farm and Palace Land Farm.

2. Materials and methods

2.1 Methodology

An assessment of the wintering bird communities present on the Knepp Castle Estate and on two nearby intensively managed farms was made from field surveys carried out along a series of transects approximately 1km in length within each area. The locations and routes followed by the transects were determined in consultation with Penny Green (Ecologist at the Knepp Estate). Of six possible transects identified within the Estate itself, four (1, 2, 4 & 5) were selected using a random number generator to reduce survey bias. The remaining two transects, which were set up as off-site controls, were on neighbouring Jenden's Farm (TQ129218) and Palace Land Farm (TQ123201). The locations of each of the six transects are shown in fig. 2.

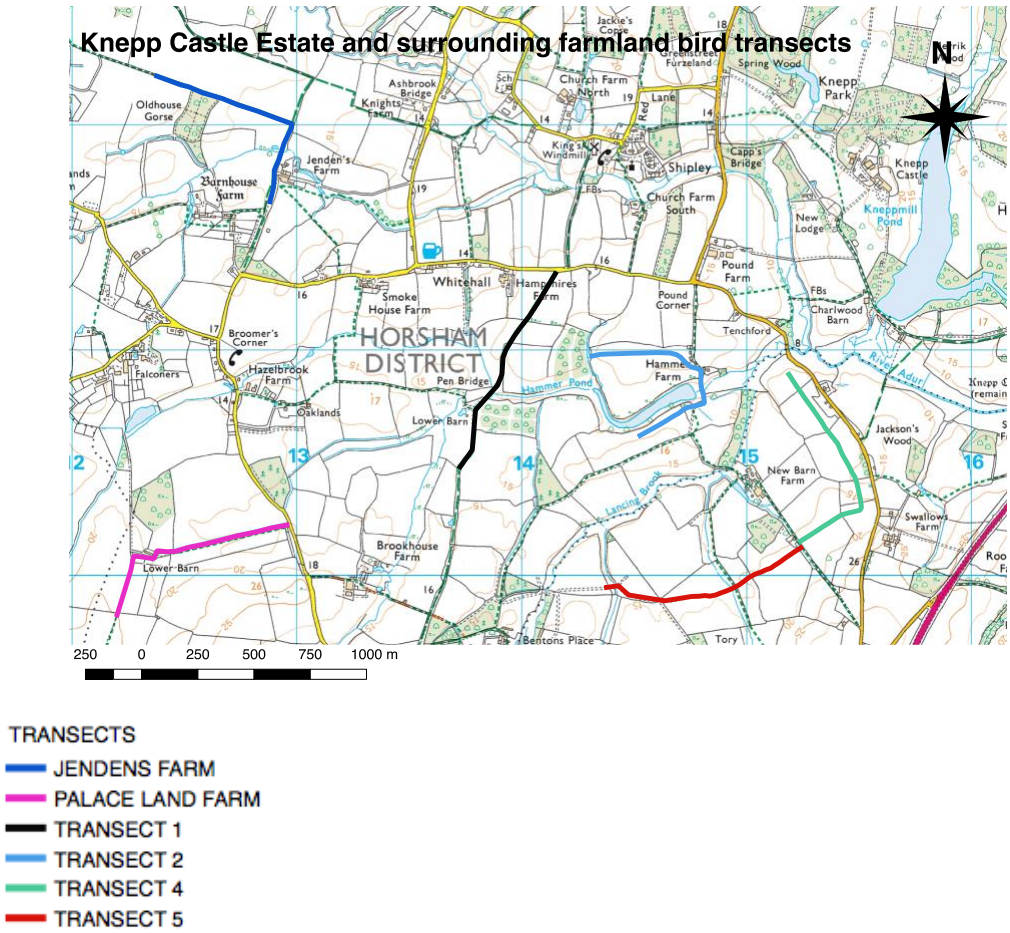

Fig. 2. Location of survey transects

Before any surveys were carried out, the transects were walked from one end to the other to increase familiarity with the routes. This also allowed photographs to be taken and a basic assessment to be made of the main habitats along each transect. Habitats were classified in accordance with the guidelines set out in the Handbook for Phase 1 habitat survey – a technique for environmental audit (JNCC 2010). Further details are given in Appendix 5.

Each transect was walked at a slow and steady pace on eight dates between late October 2017 and late February 2018, avoiding days when heavy rain or strong winds were present. Any birds encountered within a 100m corridor either side of the transect (where viewing was not impeded) were counted and recorded on large

scale field maps using the standard BTO species and activity codes (Bibby *et al.* 2000, Marchant 1983). An example of a completed field map is shown in Appendix 3. The order in which transects were walked was changed from visit to visit to avoid survey bias. The dates on which the surveys were carried out and prevailing weather conditions at the start of the surveys are shown in table 1 below.

Date	Start	Finish	Weather conditions
26/10/2017	08:10	12:43	Overcast, cloud 8/8, temp 12ºC, wind SW2, visibility 10km.
10/11/2017	08:18	12:10	Cloud 7/8, occasional light rain, temp 12ºC, wind W3, visibility 10km.
22/11/2017	07:20	11:15	Cloud 6/8, temp 13ºC, wind W3, visibility 10km.
28/12/2017	09:00	12:50	Clear, temp 0ºC, frost, wind NW1, visibility 10km.
08/01/2018	08:00	12:10	Cloud 5/8, temp 3ºC, wind ENE3, visibility 10km.
28/01/2018	08:00	12:35	Cloud 6/8, temp 11ºC, wind SW2, visibility 10km.
15/02/2018	08:35	11:50	Cloud 7/8, temp 8ºC, wind W3, visibility 10km.
27/02/2018	11:50	16:40	Cloud 4/8, snow showers, temp -2ºC, wind NE2, visibility poor in snow showers.

Table 1. Survey dates

On completion of each survey, the field maps were carefully checked for errors and then used to compile species lists and approximate numbers for each transect. Any statistical analysis of the data was carried out using Microsoft Excel.

2.2 Limitations

It is considered that the spread of dates between late October and late February is sufficient to make an assessment of the wintering bird communities present within the Knepp Estate and on the two off-site farms even though one or two less regularly occurring species may have been missed. However, the survey carried out on 15th February omitted the Jenden's Farm transect as the public right of way used to access the transect was flooded and therefore impassable.

2.3 Health & Safety

When carrying out any ecological survey, it is important that due consideration is given to Health & Safety and that the activities to be carried out by the surveyor(s) are properly risk assessed. Before the surveys commenced, a Plumpton College risk assessment (phase 2) was carried out as was a Knepp Castle Estate risk assessment in consultation with Penny Green. Copies of the relevant risk assessments can be found in Appendix 6.

3. Results

The transect surveys recorded a total of 55 species over the eight survey visits. These included 11 Red list species of high conservation concern and a further 11 Amber list species of medium conservation concern as identified by the latest assessment of the status of birds in the UK, Channel Islands and Isle of Man (Eaton *et al.* 2015). A full species list and the results of the transect surveys are given in Appendices 1-2. Species names used are those adopted in the latest IOC World Bird List (Gill & Donsker 2018).

A breakdown of the individual species totals for the four Knepp transects, Jenden's Farm and Palace Land Farm are shown in table 2 and the mean species count per transect in table 3.

	Total no. of species	No. of Red list species	No. of Amber list species
Knepp transect 1	25	4	4
Knepp transect 2	35	5	8
Knepp transect 4	29	7	3
Knepp transect 5	30	6	3
Jenden's Farm	28	5	5
Palace Land Farm	25	7	3

Table 2: Transect species totals

	Mean	Standard error
Knepp transect 1	9.6	2.0
Knepp transect 2	12.4	2.3
Knepp transect 4	14.3	3.2
Knepp transect 5	12.5	1.2
Jenden's Farm	10.6	4.9
Palace Land Farm	13.1	1.8

Table 3: Average species count per transect by date

The total numbers of birds of each species recorded during the eight survey visits varied from transect to transect and are shown in table 4.

	Knepp 1	Knepp 2	Knepp 4	Knepp 5	Jenden's Farm	Palace Land Farm	Total
Mute swan		2					2
Canada goose			33		2		35
Gadwall		14					14
Eurasian wigeon		3					3
Eurasian teal		12					12
Mallard	6	21	6		1		34
Common pheasant		1		3			4
Little grebe		1					1
Great crested grebe		1					1
Eurasian sparrowhawk			1				1
Red kite	1			1			2
Common buzzard	1	2	3	5	2	2	15
Common moorhen		10					10
Eurasian coot		6					6
Northern lapwing			47			37	84
Black-headed gull					1	29	30
Common gull						68	68
Herring gull						43	43
Common wood pigeon		3	115	7	13	3	141
Collared dove				4	1		5
European green woodpecker	1	1			3		5
Great spotted woodpecker	2	5	1				8
Common kestrel	1		2		1		4
Peregrine falcon			1				1
Eurasian jay	5	3		1			9
Eurasian magpie		1	17	10	10		38
Western jackdaw	3	39	42	28		52	154
Rook			16		12		28
Carrion crow	6	9	63	8	174	74	334
Goldcrest	2	4	3	3	4	1	17

Eurasian blue tit	16	5	15	2	12	6	56
Great tit	12	3	6	6	9	1	37
Eurasian skylark						10	10
Long-tailed tit	3	3	9	6			21
Eurasian nuthatch	5	2	1	2	2		12
Eurasian treecreeper	1						1
Eurasian wren	10	6	4	14	4	4	42
Common starling	23	73	308	94	67	626	1191
Common blackbird	21	30	26	24	21	4	126
Fieldfare	13	2	140	32	144	45	376
Song thrush	2	4	1	5	2	3	17
Redwing	15	9	171	86	100	12	393
European robin	24	23	9	14	10	6	86
Mistle thrush		1					1
Dunnock	2	4	4	8	4	1	23
European stonechat				4		17	21
House sparrow		2			28	1	31
Pied wagtail			6		3	17	26
Meadow pipit			1			67	68
Eurasian chaffinch	3				2	2	7
Hawfinch		5	2				7
Eurasian bullfinch	7		24		3	1	35
Common linnet				10			10
European goldfinch		5		20	1		26
Yellowhammer						1	1

Table 4 – Total number of records within 100m corridor of transect

The 55 species listed in table 3 include ten species of conservation concern that can be regarded as typical farmland birds in Sussex although they do occur in other habitats as well. Each is described in more detail below:

3.1 Northern lapwing

In Sussex, the lapwing is a 'scarce or fairly common but declining resident and very common winter visitor' (Thomas 2014). After the breeding season, numbers of lapwing are supplemented through the autumn and winter by the arrival of birds from continental Europe. They gather into flocks and can be found especially in the river valleys and wetland areas. Numbers on inland farmland have decreased with a move away towards coastal wetlands as a result of farming changes (Gillings 2001). In a typical winter, the county population is around 10,000-20,000 (Newnham *et al.* 2006) although numbers fluctuate between and within years, especially in cold weather when there may be large influxes from the continent.

In the current survey, lapwings were recorded on one date only (27th February 2018). At Palace Land Farm a flock of 37 was observed foraging on improved pasture while at Knepp there was a total of 47 at various locations along transect 4 foraging with fieldfares and redwings on semi-improved grassland grazed by deer and ponies. The weather at the time was very cold and the likelihood is that these were birds that had been displaced from elsewhere by the freezing conditions. Despite the sub-zero temperatures, the top soil was unfrozen allowing the birds to forage for earthworms and other invertebrates.

3.2 Black-headed gull

In Sussex, the black-headed gull is a 'common breeding species and very common to abundant passage migrant and winter visitor' (Thomas 2014). In winter, the local population is mostly replaced by continental birds (Newnham 1986). Being ubiquitous, black-headed gulls can be found almost anywhere although in winter they favour estuaries and inland sites including wet meadows, ploughed arable fields and areas of amenity and improved grassland.

In the current survey, black-headed gulls were recorded in small numbers (<15) on four dates foraging on improved pasture with common gulls at Palace Land Farm. None was recorded from any of the Knepp transects.

3.3 Common gull

In Sussex, the common gull is mainly a 'very common winter visitor and passage migrant'. In the 2007-11 Winter Atlas it was found in nearly half the county's tetrads mainly on the coast but also on the levels around Rye and on much of the South Downs. It was absent from large areas of NW Sussex and the Weald in East Sussex (Thomas 2014).

In the current survey, common gulls were recorded in small numbers on two dates foraging on improved pasture at Palace Land Farm. The peak count was 60 on 28th December 2017. None was recorded from any of the Knepp transects or Jenden's Farm.

3.4 Eurasian skylark

In Sussex, the skylark is a 'very common but declining resident; and probable common passage migrant and winter visitor'. In the 2007-11 Winter Atlas, it was recorded in 55% of the county's tetrads, mainly on the Downs and coast plain (Thomas 2014). In some winters, numbers can be supplemented by cold weather movements from the Continent.

In the current survey, a total of just ten skylarks was recorded on four dates on arable farmland at Palace Land Farm, with a peak count of six on 26th October 2017. None was recorded from any of the Knepp transects or Jenden's Farm nor was there any evidence of an influx of birds in response to the cold weather in late February.

3.5 Common starling

In Sussex, the starling is a 'common but declining resident; and very common to abundant winter visitor'. From September onwards, very large numbers of migrants from the continent supplement the largely sedentary resident population. In the 2007-11 Winter Atlas, starlings were recorded from 91% of the county tetrads with the largest numbers occurring on wet grassland on the coastal plain and in the river valleys (Thomas 2014).

In the current survey, starlings were recorded on all eight dates and from all the transects but not on every visit. Numbers were typically small (<100) with the exception of a flock of ca. 500 foraging on improved pasture at Palace Land Farm on 28th December 2017 (see table 5). No attempt was made to apply statistical

tests to the data as it contains 'outliers' with the potential to affect the reliability of any analysis.

3.6 Fieldfare

In Sussex, the fieldfare is a 'common, occasionally very common, passage migrant and winter visitor'. During the 2007-11 Winter Atlas, it was found in 82% of the county's tetrads with the greatest densities in less wooded areas, especially the Downs and Low Weald (Thomas 2014). In some winters, numbers can be supplemented by cold weather movements from the Continent or from other parts of the UK experiencing more extreme conditions.

In the current survey, fieldfares were recorded on seven of the eight surveys dates and from all transects (see table 6). Total numbers were typically small (<50) with the exception of 100 foraging with redwings in a horse paddock at Jenden's Farm on 28th December 2017. The application of a statistical test (One-way Anova) to the data reveals no significant difference in the mean number of fieldfares for each transect. See Appendix 4 for statistical output.

3.7 Redwing

In Sussex, the redwing is a 'common, occasionally very common, passage migrant and winter visitor. During the 2007-11 Winter Atlas, it was found in 91% of the county's tetrads with the greatest densities in the river valleys and Low Weald. Like fieldfare, in some winters, numbers can be supplemented by cold weather movements from the Continent or from other parts of the UK experiencing more extreme conditions.

In the current survey, redwings were recorded on all eight survey dates and from all six transects (see table 7). However, the total numbers were small with a peak count of 50 feeding with fieldfares in a horse paddock at Jenden's Farm on 28th December 2017 and there was no evidence of an influx of birds in late February in response to the cold weather. The application of statistical tests (One-way Anova/t-Test) to the data reveals a significant difference in the mean number of redwings for each transect. See Appendix 4 for statistical output.

3.8 Meadow pipit

In Sussex, the meadow pipit is a 'common but declining resident; very common passage migrant and winter visitor'. In the 2007-11 Winter Atlas it was recorded in 56% of the county's tetrads with a preference for open, extensive rough and grassy habitats (Thomas 2014).

In the current survey, meadow pipits were recorded on five dates foraging on improved pasture at Palace Land Farm with a peak count of 19 on 10th November 2017. The only other record was of one on transect 4 at Knepp on 27th February 2018.

3.9 Common linnet

In Sussex, the linnet is a 'common but decreasing resident and partial migrant'. In the 2007-11 Winter Atlas, it was recorded in 31% of the county's tetrads (Thomas 2014).

In the current survey, the only record was of a flock of ten on transect 5 at Knepp on 10th November 2017. Very large numbers of this declining farmland have been

recorded in the Knepp area in the past with a flock of 750 at nearby Shipley in January 2009 (Thomas 2014).

3.10 Yellowhammer

In Sussex, the yellowhammer is a 'fairly common resident'. During the 2007-11 Winter Atlas, it was found in 47% of the county's tetrads compared with 74% in the breeding season. In winter, they form flocks in fields and farmyards where seeds are abundant (Thomas 2014). Surprisingly, just one bird was recorded during the current survey, on arable land at Palace Land Farm on 28th December 2017.

Although not strictly farmland birds, the surveys did record a number of other interesting species. These included:

3.11 Red kite

In Sussex, the red kite is a 'very scarce breeding resident and scarce but increasing visitor'. After an absence of approximately 200 years, it returned to breed in the county in 2004 following a successful re-introduction programme in the Chilterns during 1989-94. During the 2007-11 Winter Atlas, it was found in 8% of the county's tetrads, mainly on the Downs in West Sussex (Thomas 2014).

In the current survey, single birds (perhaps the same) were recorded on transects 1 and 5 at Knepp on 15th February 2018.

3.12 European stonechat

In Sussex, the stonechat is a ‘fairly common resident and partial migrant’. During the 2007-11 Winter Atlas, it was found in 31% of the county’s tetrads, mostly on the coastal plain, inland heaths and river valleys. In a typical winter, about 100 birds remain in the county (Thomas 2014).

In the current survey, a pair overwintered at Palace Land Farm while at Knepp there were two on transect 5 on 28th December 2017 and singles on 28th January and 15th February 2018. Stonechat is reportedly a scarce bird on the Knepp Estate (Penny Green *pers. comm.*).

3.13 Hawfinch

The hawfinch is an enigmatic and shy species. In Sussex, it is a ‘scarce or possibly very scarce breeding resident and very scarce passage migrant’. In the 2007-11 Winter Atlas, it was found in low numbers in 24 widely scattered tetrads throughout in Sussex (Thomas 2014).

In autumn 2017, there was an unprecedented influx of hawfinches into the UK from the Continent involving probably thousands of birds although the numbers have not yet been properly documented. Many stayed to winter in the UK with reports of roosts of up to 400 in West Sussex and 600 in Surrey.

In the current survey, a total of seven hawfinches was recorded in the Knepp Estate on five dates comprising two on transect 5 on 22nd December 2017 and five on transect 4 on four dates between 28th December 2017 and 27th February 2018.

3.14 Eurasian bullfinch

The bullfinch is a shy and often unobtrusive species of open woodland, mature scrub and dense hedgerows. It Sussex, it is a 'fairly common or common resident'. In the Winter Atlas, it was recorded in 72% of the county's tetrads mainly away from the coast and urban areas (Thomas 2014).

In the current survey, bullfinches were recorded on all but one date (8th January 2018). With the exception of one at Jenden's Farm on 27th February 2018, all the other records were from the Knepp Estate, especially transect 2, where there was an exceptional count of 18 on 22nd November 2018.

4.1 Conclusions

The results of the transect surveys carried out over the period October 2017 – February 2018 reveal that the Knepp Castle Estate supports a diverse wintering bird community and are further evidence of the ongoing success of the Wildland Project as a large scale conservation strategy. Of the 55 bird species recorded by the surveys, all but four (black-headed gull, common gull, Eurasian skylark and yellowhammer) were recorded within the Estate itself, including an impressive 18 species of high or medium conservation concern. Redhead *et al.*. 2018 found significantly higher numbers of some farmland birds in areas where agri-environmental schemes (AES) had been implemented. However, it appears that re-wilding the Knepp Estate has not have the same effect as agri-environmental schemes given that some farmland 'specialists' such as skylark and yellowhammer were not recorded on the Estate during the surveys, despite being found on neighbouring farms.

The survey results reveal differences in the species recorded, both within different parts of the Estate, and on the adjacent Jenden's and Palace Land Farms. These differences can be linked to habitat preferences and to the availability of food resources within each area. A discussion of the factors determining the numbers and distribution of some of the species recorded can be found in the following section.

5. Discussion

5.1 Northern lapwing

The survey results suggest that lapwing is not a regular winter visitor to the Knepp Estate nor to Jenden's and Palace Land Farms. The only date on which the species was recorded was 27th February 2018, following a spell of very cold weather during which there was an influx of lapwing (and other species) into Sussex. In winter, lapwing are usually found in flocks feeding in large, open areas of grassland and ploughed fields where food is more plentiful than in other areas (Village & Westwood 1994). Of the four transects at Knepp, three pass through areas which are now unsuitable for lapwing having become 'scrubbed up' since the start of the Wildland Project with bramble and fallow. Only transect 4, which passes through large, open fields where scrub has not yet encroached, offers suitable habitat for lapwing. Although lapwing are more abundant on unimproved fields (Barnett *et al.* 2004), they will use areas of improved grassland such as those found at Palace Land Farm, where the short sward height allows them to forage for earthworms and other soil-dwelling invertebrates.

5.2 Black-headed gull

With the exception of a single bird at Jenden's Farm on 28th December 2017, all the other records for this species were from Palace Land Farm where a maximum of 15 was observed foraging with common gulls on improved sheep pasture, also on 28th December. Studies have shown that black-headed gulls favour improved grassland but are largely absent from unimproved grassland (Newton 2017). The complete lack of records from the Knepp transects during the current survey is

most likely due to the absence of improved grassland within the Estate, with many of the fields now colonized by scrub.

5.3 Common gull

During the current survey, common gulls were only recorded at Palace Land Farm where a maximum of 60 was observed foraging with black-headed gulls on improved sheep pasture on 28th December 2017. The species shows a preference for following the plough, where they seize any invertebrates turned to the surface (Newton 2017) and improved grassland where they forage for earthworms. The complete lack of records for the Knepp transects during the current survey can be explained by the absence of improved grassland and ploughed fields within the Estate.

5.4 Eurasian skylark

During the current survey, the only records of skylark were from Palace Land Farm where a total was recorded on four dates, including six on 26th October 2018. Studies have shown that this granivorous species rarely feeds on fields with small weed-seed densities below 450/m^2 (Stephens *et al.* 2003). With many of the fields at Knepp now scrubbed over with bramble and sallow, it may that there is insufficient food to support them. Alternatively, skylarks may only be present in the Low Weald in small numbers during the winter.

5.5 Common starling

In the current survey, numbers of starlings were typically small (<100) with the exception of a flock of ca. 500 foraging on improved pasture at Palace Land Farm

on 28th December 2017. The preference shown for improved pasture is not unexpected as the grass is short allowing access to food such as soil-dwelling worms and invertebrates. The open fields at Palace Land Farm also allow all round visibility to detect approaching predators such as sparrowhawks.

5.6 Fieldfare

Fieldfares were recorded from all six transects in varying numbers although the application of a statistical test (One-way Anova) to the data reveals no significant difference in the mean number of birds per transect. There were however observable differences in the occurrence of fieldfares at Knepp compared with Jenden's Farm where both species were recorded regularly throughout the winter. At Knepp, the pattern of occurrence is one of small flocks (<20) at scattered locations across the Estate whereas at Jenden's Farm, a single flock of ca. 100 was observed feeding with redwings in a horse paddock on 28th December 2017. The latter is the only area of suitable habitat at Jenden's Farm for winter thrushes while at Knepp there are many suitable areas throughout the Estate where small numbers of fieldfares may gather to feed. The results also show that areas of dense scrub as found on transect 2 at Knepp are avoided although they may be used for roosting by both fieldfare and redwing at night (Penny Green *pers. comm.*).

5.7 Redwing

Redwings were recorded on all eight survey dates and from all six transects. Numbers, however, were small with a peak count of 50 with fieldfares at Jenden's Farm on 28th December 2018. The pattern of occurrence was similar to fieldfare with small groups (typically <10) scattered across the Knepp Estate unlike Jenden's Farm where the birds were concentrated in one area. Applying statistical

tests to the data reveals significant differences between some of the transects, for example Knepp 2 and 5 and Knepp 5 and Jenden's Farm. As with fieldfare, areas of dense scrub are avoided although they may be used for communal roosting at night.

5.8 Meadow pipit

Up to 19 meadow pipits were recorded on five dates at Palace Land Farm feeding from improved pasture, where they pick arthropods off the soil surface or low vegetation (Newton 2017). The only other record was of one on transect 4 at Knepp on 27th February 2018. The reasons why meadow pipits favoured Palace Land Farm over other locations is unclear but may be linked to the shorter sward height which allows them to forage successfully. Interestingly, the meadow pipits were feeding alongside pied wagtails which also forage for arthropods.

5.9 Common linnet

In the current survey, the only record was of ten on transect 5 at Knepp on 10th November 2017. The scarcity of this farmland specialist in this study is hard to explain although it may be that the fields at Knepp and the two off-site controls do not sufficient weeds for the birds to feed on. Moorcroft *et al..* (2002) found that, in autumn and winter, linnets rarely fed on fields with weed-seed densities less than 250/m^2.

5.10 Yellowhammer

Surprisingly, there was just one record of yellowhammer in this study, a single bird at Palace Land Farm on 28th December 2017. Studies have shown that yellowhammers move around, forming flocks temporarily wherever food is plentiful (Stoate *et al.* 1988). Given that Redhead *et al.* (2018) found significantly increased numbers of some farmland birds in areas where agri-environmental schemes (AES) had been implemented, it might be expected that the Knepp Estate would hold more yellowhammers compared with off-site controls but this does not appear to be the case. The reasons for this are unclear although it may be that yellowhammers are only present in the Low Weald in small numbers and are easily missed by surveys.

6. Suggestions for further work

The study by Redhead *et al..* 2018 into the effects of agri-environmental habitat provision on winter abundance of farmland birds was carried out over three consecutive winters with nine different transects walked in each of December, January and February. To improve the reliability of the data collected at Knepp and at the off-site controls, surveys would need to be carried out more often and along additional transects, both at Knepp and on surrounding farmland, ideally extending over more than one winter.

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Appendices

Appendix 1 – List of species recorded

		BoCC Red-list	BoCC Amber-list
Mute swan	*Cygnus olor*		*
Canada goose	*Branta canadensis*		
Gadwall	*Mareca strepera*		*
Eurasian wigeon	*Mareca penelope*		*
Eurasian teal	*Anas crecca*		*
Mallard	*Anas platyrhynchos*		*
Common pheasant	*Phasianus colchicus*		
Little grebe	*Tachybaptus ruficollis*		
Great crested grebe	*Podiceps cristatus*		
Eurasian sparrowhawk	*Accipiter nisus*		
Red kite	*Milvus milvus*		
Common buzzard	*Buteo buteo*		
Common moorhen	*Gallinula chloropus*		
Eurasian coot	*Fulica atra*		
Northern lapwing	*Vanellus vanellus*	*	
Black-headed gull	*Chroicocephalus ridibundus*		*
Common gull	*Larus canus*		*
Herring gull	*Larus argentatus*	*	
Common wood pigeon	*Columba palumbus*		
Collared dove	*Streptopelia decaocto*		
European green woodpecker	*Picus viridis*		

Great spotted woodpecker	*Dendrocopus major*		
Common kestrel	*Falco tinnunculus*		*
Peregrine falcon	*Falco peregrinus*		
Eurasian jay	*Garrulus glandarius*		
Eurasian magpie	*Pica pica*		
Western jackdaw	*Corvus monedula*		
Rook	*Corvus frugilegus*		
Carrion crow	*Corvus corone*		
Goldcrest	*Regulus regulus*		
Eurasian blue tit	*Cyanistes caeruleus*		
Great tit	*Parus major*		
Eurasian skylark	*Alauda arvensis*	*	
Long-tailed tit	*Aegithalos caudatus*		
Eurasian nuthatch	*Sitta europaea*		
Eurasian treecreeper	*Certhia familaris*		
Eurasian wren	*Troglodytes troglodytes*		
Common starling	*Sturnus vulgaris*	*	
Common blackbird	*Turdus merula*		
Fieldfare	*Turdus pilaris*	*	
Song thrush	*Turdus philomelos*	*	
Redwing	*Turdus iliacus*	*	
Mistle thrush	*Turdus viscivorus*	*	
European robin	*Erithacus rubecula*		
Dunnock	*Prunella modularis*		*
European stonechat	*Saxicola rubicola*		
House sparrow	*Passer domesticus*		

Pied wagtail	*Motacilla alba yarrellii*		
Meadow pipit	*Anthus pratensis*		*
Common chaffinch	*Fringilla coelebs*		
Hawfinch	*Coccothraustes coccothraustes*	*	
Eurasian bullfinch	*Pyrrhula pyrrhula*		*
Common linnet	*Linaria cannabina*	*	
European goldfinch	*Carduelis carduelis*		
Yellowhammer	*Emberiza citrinella*	*	

Appendix 2 – Results of transect surveys

Date: 26th October 2017

Weather: Overcast, cloud 8/8, temp 12°C, wind SW2, visibility 10km.

	Knepp 1	Knepp 2	Knepp 4	Knepp 5	Jenden's Farm	Palace Land Farm
Mute swan		2				
Great crested grebe		1				
Eurasian wigeon		3				
Mallard	6		4			
Common pheasant				2		
Common wood pigeon			46	2	7	
Collared dove				2		
Eurasian jay		1				
Eurasian magpie			2		2	
Western jackdaw		9	2	2		
Carrion crow	1	1		2	8	4
Goldcrest			2	1		1
Eurasian blue tit			5		3	1
Great tit	1	1	2	3		
Eurasian skylark						6
Long-tailed tit			6			
Nuthatch	4					
Eurasian wren	1		1	3	1	
Common starling		23			16	70

Common blackbird	1	3	2	6		
Song thrush		1			2	
Redwing			11	7		
European robin	5	4	2	8		1
Dunnock	2	1		2	1	
House sparrow					3	
Pied wagtail			3		2	
Meadow pipit						17
European stonechat						3
Eurasian chaffinch			1			2
Eurasian bullfinch	2					
European goldfinch		2			1	
Total no. of species	9	13	15	13	11	9

Date: 10th November 2017

Weather: Cloud 7/8, occasional light rain, temp 12°C, wind W3, visibility 10km.

	Knepp 1	Knepp 2	Knepp 4	Knepp 5	Jenden's Farm	Palace Land Farm
Common buzzard		2	1	1	2	1
Common moorhen		4				
Herring gull		16	4		6	3
Common wood pigeon	1	22	6	76	42	31
European green woodpecker					1	
Great spotted woodpecker		2				
Common kestrel					1	
Peregrine falcon			1			
Eurasian magpie			3			
Rook			3		2	
Carrion crow	2	2	38	7	145	11
Goldcrest	1	2	1	1	3	
Eurasian blue tit	5					
Great tit	2			1	1	
Eurasian wren		4	1	2		1
Common starling				90	51	
Common blackbird	4	4	3	1	8	1
Fieldfare	6		21	1		
Redwing		4	25	14	1	
European robin		4				
Dunnock			2			

House sparrow					1	
Meadow pipit						19
European stonechat						2
Eurasian chaffinch						1
Eurasian bullfinch		4				
Common linnet				10		
European goldfinch		3		13		
Total no. of species	7	13	12	12	13	9

Date: 22nd November 2017

Weather: Cloud 6/8, temp 13ºC, wind W3, visibility 10km.

	Knepp 1	Knepp 2	Knepp 4	Knepp 5	Jenden's Farm	Palace Land Farm
Canada goose			33			
Mallard		4	4		4	
Little grebe		1				
Common buzzard				1		
Common moorhen		1				
Herring gull			2	2	10	1
Common wood pigeon	1	9	7		13	
Great spotted woodpecker		1				
Common kestrel				1		
Eurasian jay	2	1		1		
Eurasian magpie			2	1	1	
Western jackdaw			1	3		25
Carrion crow		1	2		4	20
Goldcrest		2		1		
Eurasian blue tit		2	1		4	
Great tit		1				
Long-tailed tit				6		
Eurasian nuthatch		1				
Eurasian wren	4	1		6	1	
Common starling			3	3		
Common blackbird	2	9	4	5	7	

Fieldfare	6		7		20	
Redwing	2	2	13	7	1	
European robin	2	1			1	
House sparrow					1	
Pied wagtail			1			
Meadow pipit						4
European stonechat						2
Eurasian chaffinch	1				1	
Hawfinch				2		
Eurasian bullfinch		18				
Total no. of species	8	16	13	14	13	5

Date: 28th December 2018

Weather: Clear, temp 0°C, frost, wind NW1, visibility 10km.

	Knepp 1	Knepp 2	Knepp 4	Knepp 5	Jenden's Farm	Palace Land Farm
Gadwall		14				
Eurasian teal		12				
Mallard		2				
Eurasian sparrowhawk			1			
Common buzzard			1	2		1
Black-headed gull					1	15
Common gull						60
Herring gull						35
Common wood pigeon				2		3
Collared dove				1		
European green woodpecker		1			1	
Great spotted woodpecker	1	1				
Common kestrel			1			
Eurasian jay	1	1				
Eurasian magpie				1	3	
Western jackdaw	2	2	30			3
Rook			13			1
Carrion crow				1	1	5
Goldcrest	1				1	
Eurasian blue tit	3	1	1		1	3
Great tit	2					

Eurasian nuthatch		1			2	
Eurasian treecreeper	1					
Eurasian wren	2		1		1	1
Common starling			65			500
Common blackbird	3	4	2	2	4	
Fieldfare	1	2	17	4	100	6
Song thrush				2		3
Redwing	6		44	2	50	1
European robin	4	1	1	1	3	1
Dunnock				2	2	
House sparrow					3	1
Pied wagtail						15
Meadow pipit						15
European stonechat				2		2
Eurasian chaffinch			1			
Hawfinch			1			
Eurasian bullfinch	3	1		3		
Yellowhammer						1
Total no. of species	13	13	14	13	14	20

Date: 8th January 2018

Weather: Cloud 5/8, temp 3°C, wind ENE3, visibility 10km.

	Knepp 1	Knepp 2	Knepp 3	Knepp 4	Jenden's Farm	Palace Land Farm
Mallard		3			1	
Common buzzard	1			1		
Moorhen		2				
Black-headed gull						1
Herring gull					1	4
Common wood pigeon		1	2	3	1	
Collared dove				1		
European green woodpecker	1				1	
Great spotted woodpecker		1				
Common kestrel			1			
Eurasian magpie		1	3	1	1	
Western jackdaw	1	8	3	2		10
Carrion crow	1	2		2	15	25
Eurasian blue tit	3	1	3	1	1	
Great tit	1		1	1	1	
Eurasian skylark						1
Eurasian nuthatch	1					
Eurasian wren	1	1		1		
Common starling	13	20	48			25
Common blackbird	2	1	2	1		
Fieldfare			16	15	15	

Song thrush		1				
Redwing	1	3	20	11	10	
European robin	1	1	1	2	1	1
Dunnock				3		
House sparrow					10	
Pied wagtail					1	1
Meadow pipit						10
European stonechat						2
Eurasian chaffinch					1	1
Hawfinch			1			
Total no. of species	12	14	12	14	14	11

Date: 28th January 2018

Weather: Cloud 6/8, temp 11°C, wind SW2, visibility 10km.

	Knepp 1	Knepp 2	Knepp 4	Knepp 5	Jenden's Farm	Palace Land Farm
Mallard		4				
Common buzzard			1	1		1
Common moorhen		3				
Black-headed gull						10
Herring gull					3	
Common wood pigeon		2	1		5	
European green woodpecker	1					
Eurasian magpie			6	3	1	
Western jackdaw			6			
Carrion crow	3	5	9		15	23
Eurasian blue tit	1	1	1	1	2	2
Great tit	2	1	1	1	3	1
Eurasian skylark						2
Eurasian nuthatch			1			
Eurasian wren	1		1	1		2
Common starling	10		32			15
Common blackbird	2	3	2	4		1
Fieldfare			12	10	3	
Song thrush	1	1				
Redwing			25	27	10	
Robin	2	2	3	1	2	1

Dunnock		1	1	1	1	
House sparrow					15	
Pied wagtail			1			1
European stonechat				1		2
Eurasian chaffinch				1		
Eurasian bullfinch	1	1				
Total no. of species	10	11	16	12	11	12

Date: 15th February 2018

Weather: Cloud 7/8, temp 8°C, wind W3, visibility 10km.

	Knepp 1	Knepp 2	Knepp 4	Knepp 5	Jenden's Farm	Palace Land Farm
Mallard		10	2			
Common pheasant		1		1		
Common buzzard			1			1
Red kite	1			1		
Herring gull		14				
Great spotted woodpecker	1	1	1			
Common kestrel	1					
Western jackdaw		2				
Carrion crow						14
Eurasian blue tit	3		3			
Great tit	4		1			
Eurasian skylark						1
Long-tailed tit		3				
Eurasian nuthatch				1		
Common starling		30	100	1		
Common blackbird		3	7	1		
Fieldfare			19	1		
Song thrush				1		
Redwing			11	9		
European robin	4	3	1	1		1
European stonechat				1		2

Hawfinch			1			
Eurasian bullfinch	1					
European goldfinch				7		
Total no. of species	9	9	11	11		5

Date: 27th February 2018

Weather: Cloud 4/8, snow showers, temp -2°C, wind NE2, visibility poor in snow showers.

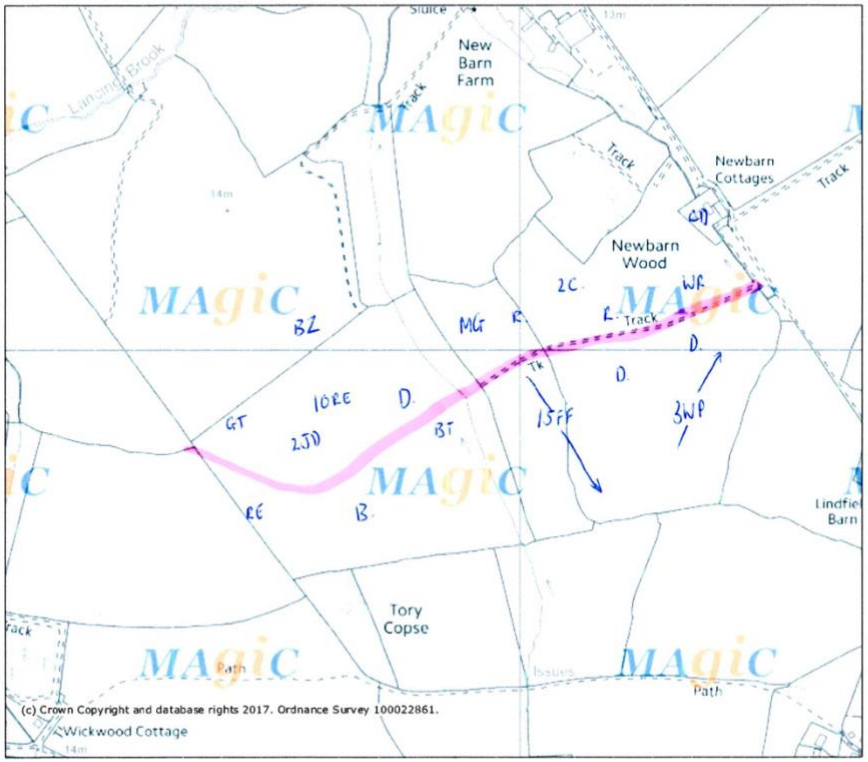
	Knepp 1	Knepp 2	Knepp 4	Knepp 5	Jenden's Farm	Palace Land Farm
Canada goose					2	
Mallard		2				
Common buzzard	1		1		2	1
Eurasian coot		6				
Northern lapwing			47			37
Black-headed gull						3
Common gull						8
Common wood pigeon			66			
Collared dove					1	
Eurasian jay	1	1				
Eurasian magpie			1	4	2	
Western jackdaw		18		21		14
Rook					12	
Carrion crow		1	1	1	2	2
Eurasian blue tit	1		1		1	
Great tit			1		4	
Long-tailed tit	3		3			
Eurasian nuthatch				1		
Eurasian wren	1			1	1	
Common starling			60			16
Common blackbird	7	3	4	4	2	2

Fieldfare			48	1	6	39
Song thrush	1	1	1	2		1
Redwing	6		22	9	28	12
Mistle thrush			1			
European robin	6	7	1	1	3	1
Dunnock		2	1	3	1	1
House sparrow		2			5	
Pied wagtail			1			
Meadow pipit			1			
European stonechat						2
Eurasian chaffinch			1			
Hawfinch			2			
Eurasian bullfinch					1	
Total no. of species	9	10	21	11	16	14

Appendix 3 – Example of field map

MAGIC

Transect 5



8/1/18

Start: 11.05am

Finish: 11.35am

Weather: 7°C Sunny Spells

Projection = OSGB36
xmin = 513800
ymin = 119500
xmax = 516000
ymax = 120500

0 0.095 0.19
km

Map produced by MAGIC on 25 October, 2017.
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Appendix 4 – Statistical analysis output

Fieldfare

Knepp 1	Knepp 2	Knepp 4	Knepp 5	Jenden's Fm	Palace Land Fm
0	0	0	0	0	0
6	0	21	1	0	0
6	0	7	0	20	0
1	2	17	4	100	6
0	0	16	15	15	0
0	0	12	10	3	0
0	0	19	1	6	0
0	0	48	1		39

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	8	13	1.625	7.410714
Column 2	8	2	0.25	0.5
Column 3	8	140	17.5	199.1429
Column 4	8	32	4	30.85714
Column 5	7	144	20.57143	1284.619
Column 6	8	45	5.625	186.2679

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	2807.036	5	561.4071	2.155827	0.077869	2.443429
Within Groups	10676.96	41	260.4138			
Total	13484	46				

Conclusion

If F > F crit, we reject the null hypothesis. This is not the case, 2.16< 2.44.

Redwing

Knepp 1	Knepp 2	Knepp 4	Knepp 5	Jenden's Fm	Palace Land Fm
0	0	11	7	0	0
0	4	25	14	1	0
2	2	13	7	1	0
6	0	44	2	50	1
1	3	20	11	10	0
0	0	25	27	10	0
0	0	11	9	69	0
0	0	48	1		12

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	8	9	1.125	4.410714
Column 2	8	9	1.125	2.696429
Column 3	8	197	24.625	207.125
Column 4	8	78	9.75	67.07143
Column 5	7	141	20.14286	770.4762
Column 6	8	13	1.625	17.69643

ANOVA

ce of Varia	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between G	4241.888	5	848.3775	5.179306	0.000896	2.443429
Within Gro	6715.857	41	163.8014			
Total	10957.74	46				

Conclusion

If F > F crit, we reject the null hypothesis. This is the case, 5.18 > 2.44. Therefore, we reject the null hypothesis. The means for the six transects are not all equal. At least one of the means is different. However, the ANOVA does not tell you where the difference lies. A t-Test is needed to test each pair of means.

t-Test: Two-Sample Assuming Unequal Variances		
	Knepp 4	**Knepp 2**
Mean	24.625	1.125
Variance	207.125	2.696428571
Observations	8	8
Hypothesized Mean Difference	0	
df	7	
t Stat	4.588681728	
P(T<=t) one-tail	0.001258852	
t Critical one-tail	1.894578605	
P(T<=t) two-tail	0.002517704	
t Critical two-tail	2.364624252	

	Knepp 4	**Palace Land Farm**
Mean	24.625	1.625
Variance	207.125	17.69642857
Observations	8	8
Hypothesized Mean Difference	0	
df	8	
t Stat	4.338644	
P(T<=t) one-tail	0.001241	
t Critical one-tail	1.859548	
P(T<=t) two-tail	0.002483	
t Critical two-tail	2.306004	

Conclusions

The above examples show the results of t-Tests which are used to test the null hypothesis that the means of two populations are equal. If t Stat > t Critical two-tail, we reject the null hypothesis. In the above examples, 4.59 > 2.36 and 4.34 > 2.31 so we can conclude that the mean number of birds for Knepp transect 4 is significantly difference to the mean for both Knepp transect 2 and Palace Land Farm.

Appendix 5 – Habitat types and photographs

Transect	Photographs	Habitat types
Knepp 1		Invading sallow & bramble scrub. Semi-improved grassland. Mature broad-leaved trees. Poached bare ground.
Knepp 1		
Knepp 2		Dense sallow scrub. Semi-improved grassland. Mature broad-leaved trees. Poached bare ground.

Knepp 2		
Knepp 4		Invading bramble scrub. Semi-improved grassland. Scattered broad-leaved trees. Poached bare ground.
Knepp 4		

Knepp 5		Invading bramble scrub. Semi-improved grassland. Scattered broad-leaved trees. Overgrown intact hedgerows.
Knepp 5		
Jenden's Farm		Improved grassland/ pasture. Tree lines. Hedgerows. Farm buildings.

Jenden's Farm		
Palace Land Farm		Improved grassland/ pasture. Arable. Ditch containing low scrub. Farm buildings.
Palace Land Farm		

Appendix 6 – Risk assessments

* check the day before if it is ok to come as deer culling goes through the winter

L3 - RISK ASSESSMENT – SITE /PROJECT / JOB SPECIFIC

DATE PREPARED:	**02/10/2015**	**REVISED: 17/3/17**	**UPDATED BY:** **KIRSTY HAYDON/PENNY GREEN**	**OTHER RELEVANT ASSESSMENTS** A3 – Lone Working
REFERENCE	**KNEPP WILDLIFE SURVEYS**			

SIGNIFICANT HAZARDS	GROUPS AT RISK	EXISTING CONTROLS	RISK			HAVING REGARD TO THE LEVEL OF RISK, WHAT ADDITIONAL CONTROL MEASURES (IF ANY) ARE REQUIRED? WHO WILL TAKE ACTION AND WHEN?
			LIKELIHOOD	SEVERITY	RISK RATING	
Tripping on uneven ground	Visitors	Safaris are led and the leader selects routes. Trained first aider accompanying safari & first aid kit in safari vehicle.	2	4	**8**	
Exposure to sun	Visitors	Advise visitors to wear sun protection cream and/or hat	2	2	**4**	
Free roaming livestock	Visitors	Visitors advised not to approach livestock. Safari leader has Stockman's contact number in case of emergency.	1	2	**2**	
Contact with harmful flora/thorny scrub	Visitors	Safari leader to be trained to identify any poisonous fauna and flora likely to be encountered.	1	2	**2**	Leader to advise of any known risks and choose routes accordingly
Tick bites	Visitors	Wear suitable clothing and check for attached ticks on return from Safari. Trained first aider accompanying visitors with full 1st aid kit including tick removal device.	2	4	**8**	
Allergic reactions	Visitors	Visitors MUST advise safari leader of any known allergies. Safari leader is a trained first aider and first aid kit will contain cooling gels. Safari leader will have grid references and landmarks noted for emergency services.	2	8	**16**	
Extreme weather	Visitors	Visitors advised to bring appropriate clothing and footwear.	1	6	**6**	
Vegetation swipe		Driver awareness and route awareness. Routes checked regularly and vegetation cut back as appropriate.				Passengers advised that when in vehicle keep head and limbs inside vehicle.
Falling tree or branches	Visitors	Avoid standing under dead trees, particularly in windy/stormy conditions	1	2	**2**	
Adder bites	Visitors	Advise visitors to wear appropriate footwear and avoid sitting in long grass	1	2	**2**	
Wooden bridges	Visitors	Bridges inspected annually by Estate staff. Any interim maintenance requirements will be reported by the Safari Leader	1			
Any bodies of water	Visitors	Visitors advised not to enter any areas of water on the estate. Visitors to take care when surveying amphibious species	1	1	**1**	

SIGNIFICANT HAZARDS	GROUPS AT RISK	EXISTING CONTROLS	RISK			HAVING REGARD TO THE LEVEL OF RISK, WHAT ADDITIONAL CONTROL MEASURES (IF ANY) ARE REQUIRED? WHO WILL TAKE ACTION AND WHEN?
			LIKELIHOOD	SEVERITY	RISK RATING	
Safari vehicles – tipping over	Visitors	Safari leader will brief visitors on safety issues to include: • Staying seated at all times • Exit door not to be opened until vehicle is stationery and engine turned off. • Keeping head and limbs inside vehicle at all times • Being aware of low roof when entering and exiting vehicle • Steps provided for ease of access • Keeping clear of vehicle if it is being manoeuvred – driver will not always be able to see directly behind vehicle 2 way radios in use to communicate from vehicle to vehicle	1	10	**10**	Lap belts to be fitted
Platforms – slips, trips and falls from height	Visitors	Safety notices in place at base of steps. Visitors briefed to take care when climbing up and down steps and not to lean out or climb the wooden railings	2	6	**12**	Anti slip treads fitted to steps on all platforms
Accessibility	Visitors	Tree platforms may be difficult for some less mobile visitors to access; this is made clear at time of booking. Safari vehicles have a high step up to gain entry. Safari leader carries a mobile step in the vehicle can assist visitors getting in and out of the vehicle. Larger vehicle has a fold down step for access.	1	4	**4**	
Lone working	Safari Leader	Mobile phone carried at all times. Lone working procedure in place – see RA - A3.	2	6	**12**	Use of walkie talkies
Cow Barn – deck area & steps	Visitors/Staff	Steps from decked area to pathway – all advised to take care as could be slippery when wet.	2	4	**8**	Area around steps regularly checked for larger stones and kept weed free to minimise risks. Cow Barn deck area to be jet washed periodically
Cow Barn – Fire risk	Visitors/Staff	Fire risk assessment undertaken and fire fighting equipment in place. Wood burning stove only used under direction of a member of staff and always closed down prior to leaving the building.	1	10	**10**	
Food poisoning	Visitors/Staff	Temperature probes for food and hand wipes for person serving visitors. Disposable gloves used for food preparation.	1	4	**4**	
Crossing road on foot	Visitors/Staff	Warning signs installed for motorists to see at crossing point and staff member wearing high-vis jacket to direct visitors across the road.	1	8	**8**	
Walking in the dark	Visitors/Staff	Powerful torch for getting in and out of back of vehicle, and to light pathway whilst walking. Visitors advised to bring their own torches.	2	2	**4**	
Cars and car parking	Break-ins whilst parked Damage whilst parked	Inform all those attending the Field visit to take all their valuables with them and not to leave them in the car. Items left out of sight in the boot are also at risk and nothing of value should be left in the boot.	2	1	**2**	

SIGNIFICANT HAZARDS	GROUPS AT RISK	EXISTING CONTROLS	RISK			HAVING REGARD TO THE LEVEL OF RISK, WHAT ADDITIONAL CONTROL MEASURES (IF ANY) ARE REQUIRED? WHO WILL TAKE ACTION AND WHEN?
			LIKELIHOOD	SEVERITY	RISK RATING	
Manual handling of heavy generators	Trips, slips, fall, injuries to body.	Ensure proper/safe lifting method used. Plan before any heavy/awkward item is moved. Do not overload. Two people to share carrying if needs be.	2	4	**8**	
Cables and power supply	Electric shock if cables unsafe. Electrical fires - vegetation catching fire. Trips over cables in dark	Ensure cabling is safe and wiring is correct before use. Check cabling for any evidence of damage to insulation eg from abrasion, burns, or even gnawing by wildlife. Ensure equipment has been serviced. Check conditions are suitable. Prevent rain from contact with electricity supply and ensure that connections are waterproof. Consider using a residual current device for extra safety. Use cable covers where cables cross pathways etc. Advise public at event to avoid any potential hazards (eg tripping on cables). Keep group away from generator area. Set generator away from trap. Torches used.	2	8	**16**	
Generator, Tilley lamp and fuel	Burns from hot bulbs, lamps and generator exhaust. Fuel fire. Contamination with fuel eg on hands	Ensure equipment has been serviced. Place lamps in safe and appropriate situation. Use a container to limit fuel spillage. Wash/clean hands after use. Carry wipes. Advise public to avoid touching generator or bulb. Generator only operated by responsible individuals and kept away from moth trap area. Torches used.	2	6	**12**	
MV light bulbs	Potential cumulative damage to eyes from UV rays. Dazzle from bright light source.	Follow manufacturers'/suppliers' instructions. Do not look directly at bulb. Consider wearing safety glasses/sunglasses if you wish. Take particular care if using the sheet method for trapping. Allow time for eyes to adjust to darkness before moving around site. Advise public to avoid hazards (e.g. wear sunglasses and/or avoid looking directly at bulb; allow eyes to adjust to darkness when moving away from lamp.)	2	6	**12**	
MV light bulbs	Damaged bulbs may, on rare occasions, burst, scattering glass fragments.	Check all bulbs for hairline fractures before use. Ensure that the bulb coating/glass filter is not cracked or removed. Replace bulb if damaged. Use a rain shield in wet conditions and avoid getting too close to the trap during heavy rain. Use of bulb guards is recommended. Advise public of the risk and keep them at a safe distance from the bulb when on.	2	4	**8**	

Likelihood: very unlikely = 1; unlikely = 2; may happen = 4; likely = 6; very likely = 8; certain = 10
Severity: delay = 1; minor injury = 2; lost time injury = 4; major injury = 6; single death = 8; multiple death = 10 Risk rating = likelihood x severity