LIFE+ Project “Reintroducing the Great Bustard Otis tarda to Southern England (LIFE09/NAT/UK/020): Year 1 Summary

01/09/2010 – 31/08/2011
Contents

A1: Produce UK species Action Plan................................................................. 3
A2: Develop a release strategy for the project period................................. 11
B2: Lease land for additional release sites and management areas........ 29
C1: Transport young bustards from Russia to the UK................................. 40
C2: Carry out health check on young bustards......................................... 41
C3: Optimise condition of current release area........................................ 57
C5: Protect bustards and their nests from direct threats......................... 67
C6: Promote existing and develop new agri-environment options.......... 68
D2: Erect project notice boards................................................................. 83
D4: Produce leaflet for local farmers and landowners........................... 84
D5: Produce promotional flyer for general public.................................. 85
D7: Carry out a program of media work.................................................. 86
D8: Run project demonstration days....................................................... 93
D9: Implement programme of public engagement work...................... 96
E2: Carry out essential conservation monitoring.................................. 97
E3: Network with other projects............................................................ 121
A1: Produce UK Species Action Plan

UK Species Action Plan for
Great Bustard (*Otis tarda*)

Prepared by the LIFE+ project “Reintroducing the Great Bustard *Otis tarda* to southern England” (LIFE09 NAT/UK/00020)
1. STATUS AND POPULATION TRENDS

Status

UK  BoCC n/a
European  SPEC 1 (Vulnerable)
Global  IUCN Red List: Vulnerable

Population/trend

UK  c10 individuals
European  39,100-45,300 individuals, decreasing (but increasing in last 20 years)
Global  43,500-51,200 individuals, decreasing (but stable in last 20 years)

Guide to distribution

The great bustard uses lowlands and undulating open countryside with dry soil and low levels of annual rainfall. The species probably originated in natural grasslands such as steppes and similar warm open habitats. However, it has adapted well to agricultural landscapes with a high diversity of crops and a low intensity of cultivation and disturbance. With the advent of mechanised agriculture the species’ range severely contracted in the 19th and 20th centuries and it has become extinct in many countries. Consequently its range is extremely fragmented.
Although the long term population trend is downwards, due to a steep decline up to around 1990, total numbers have not decreased during the last 20 years. This is largely due to an overall positive trend in the Iberian Peninsula. Several small central European populations are also recovering, due to active conservation measures. Despite this, a reduction in range is still occurring. Great bustards have disappeared from less favourable sites even in parts of their range where their population is increasing, showing a tendency to congregate at sites with high quality habitat.

The range of the great bustard stretches from Iberia in the west to China in the east, but 90% of the world population is found in Europe. Around 60% of the world population occurs in Spain, and around 20% in European Russia. Portugal and Hungary each have around 3%. There are small populations in several other European countries, including Ukraine, Austria and Germany.

The main threats to the species across its range, other than its extremely fragmented distribution, are the loss and degradation of its habitat through agricultural intensification, land use changes and infrastructure development, increased mortality caused mainly by power lines, and reduced reproductive success due to high levels of nest destruction by mechanised farming and high chick mortality through predation and starvation.

2. UK REINTRODUCTION PROJECT

A 10 year trial reintroduction project is underway to work towards the establishment of a self sustaining population around Salisbury Plain in Wiltshire. This was one of the last strongholds of the species before it became extinct in the UK in 1832. The project has been led by the Great Bustard Group since the first releases in 2004. The aim of the project is to release up to 40 young birds annually to secure a self sustaining population of around 100 birds. In 2009 the RSPB joined the Great Bustard Group and the University of Bath in the Great Bustard Consortium. Then in September 2010, a LIFE+ project (“Reintroducing the great bustard Otis tarda to southern England”) started, involving the three members of the Great Bustard Consortium and Natural England. This project will run until August 2015.

A mid term review of the first five years of the project measured its progress against some of the key parameters. At the pre-release stage, the project has achieved good hatching success of eggs gathered in Russia and excellent survival of chicks up to release. The main issue is the number of chicks being brought from Russia each year, significantly below the target.
The project achieved several positive qualitative indicators of success in its first few years. Released juveniles have shown the ability to survive in the UK, with birds reaching adulthood from every year of release. Birds have remained in the UK, and stayed site faithful to the release site, where lekking has occurred involving several males. The biggest success came in 2009 when the first great bustard chicks for 175 years hatched in the wild in the UK. This was followed by further chicks in 2010 and 2011. Three great bustards have so far fledged in the wild in the UK.

Despite these successes, key survival targets have not been met. Survival of released birds to the end of their first year has been lower than expected, and survival of adults has been just below the target figure. The two primary issues for the reintroduction project are therefore the number of birds being released and the level of post-release mortality. Post-release mortality, particularly through predation and collisions, may be a consequence of the condition of birds being released. A particular focus for the project is to improve on rear and release techniques to provide birds better able to survive in the UK.

3. ISSUES AFFECTING RECOVERY

<table>
<thead>
<tr>
<th>3a. Current threats to conservation status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Low post-release survival of birds from translocation project.</td>
</tr>
<tr>
<td>2 Predation of eggs/young preventing adequate productivity to increase population.</td>
</tr>
<tr>
<td>3 Collisions with power lines or fences causing mortality of juvenile and adult bustards.</td>
</tr>
<tr>
<td>4 Human disturbance, particularly of nesting birds.</td>
</tr>
<tr>
<td>5 Intensive arable farming reducing availability of suitable habitat.</td>
</tr>
<tr>
<td>6 High mortality in harsh winters due to increased dispersal.</td>
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</tbody>
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<table>
<thead>
<tr>
<th>3b. Constraints to delivery of conservation action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Low number of birds available for release since start of project.</td>
</tr>
<tr>
<td>2 Behaviour of the species – the tendency of released birds to disperse in the autumn and the solitary and elusive nature of birds.</td>
</tr>
<tr>
<td>3 Global experience of great bustard translocation inadequately developed; current rear and release techniques do not equip birds with appropriate behaviour.</td>
</tr>
<tr>
<td>4 High fox population on MoD land and consequent high predation levels for released birds and breeding attempts.</td>
</tr>
</tbody>
</table>
5  Incomplete understanding of key issues affecting post-release survival.  Medium
6  Problems arising from the attachment of tags/tracking devices  Low
7  Limited budget within agri-environment schemes to fund appropriate actions; great bustard not a target species in Higher Level Stewardship.  Low
8  Great bustard not currently protected under Schedule 1 of the Wildlife and Countryside Act.  Low

4. TARGETS FOR RECOVERY

4a. LIFE+ targets, to be met by the end of the LIFE+ project in August 2015
1  The UK great bustard population will reach approximately 50 individuals.
2  At least 20 young great bustards each year will have been released in Wiltshire.
3  There will have been no detectable reduction in productivity caused by disturbance.
4  An enhanced monitoring programme will have been implemented to improve understanding of issues affecting survival and productivity.
5  More extensive areas of suitable habitat will have been secured across a wider area.


<table>
<thead>
<tr>
<th>Measure</th>
<th>Adequate</th>
<th>Excellent</th>
<th>Reintroduction project 2004-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hatching success of first clutches</td>
<td>54%</td>
<td>75%</td>
<td>66.4% (232)</td>
</tr>
<tr>
<td>2 Number of chicks moved from Russia each year</td>
<td>30</td>
<td>40</td>
<td>20.4 ± 5.9 (5)</td>
</tr>
<tr>
<td>3 Pre-release survival (males)</td>
<td>53%</td>
<td>75%</td>
<td>88.0 ± 6.3% (102)</td>
</tr>
<tr>
<td>4 Pre-release survival (females)</td>
<td>45%</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>5 Post-release survival to end of year one (males)</td>
<td>25%</td>
<td>28%</td>
<td>18.2 ± 4.6% (89)</td>
</tr>
<tr>
<td>6 Post-release survival to end of year one (females)</td>
<td>38%</td>
<td>42%</td>
<td>95% CI 10.8% - 28.9%</td>
</tr>
<tr>
<td>7 Post-release survival from year one per annum (males)</td>
<td>78%</td>
<td>87%</td>
<td>74.6 ± 10.0% (10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>95% CI 51.4% - 89.2%</td>
</tr>
</tbody>
</table>

[Male and female data are pooled]
8 Post-release survival from year one per annum (females) 83% 92% pooled
9 Hatching success of wild-laid eggs (where nests are located) 60% 70%
10 Proportion of females >4 years old that breed 60% 70%
11 Productivity (chicks/adult female by September) 0.28 0.35
12 Survival of young from September to end of first year 50% 55%
13 Annual survival of wild reared birds in second and subsequent years 90% 92%

4c. Long term targets
1 To secure a self-sustaining population of around 100 birds in Wiltshire.
2 To seek a recovery of great bustards to as much of their former UK range as is suitable.

5. ACTIONS TOWARDS RECOVERY

<table>
<thead>
<tr>
<th>Action</th>
<th>Organisations responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Research and monitoring</td>
<td>University of Bath, RSPB, GBG</td>
</tr>
<tr>
<td>a Implement enhanced monitoring programme to improve understanding of issues affecting survival and productivity.</td>
<td>GBG, University of Chester</td>
</tr>
<tr>
<td>b Develop an effective method of tracking birds in the field at critical times through appropriate use of new technology.</td>
<td>University of Bath, RSPB</td>
</tr>
<tr>
<td>c Ascertain genetic diversity of great bustard populations to determine suitability for translocations.</td>
<td></td>
</tr>
<tr>
<td>2 Advisory</td>
<td>RSPB, NE</td>
</tr>
<tr>
<td>a Provide targeted land management advice to farmers/landowners and assist in delivery of agri-environment schemes.</td>
<td></td>
</tr>
<tr>
<td>3 Land-use policy/legislation</td>
<td></td>
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## LIFE+ Project “Reintroducing the Great Bustard Otis tarda to Southern England (LIFE09/NAT/UK/020): Year 1 Summary

### 4 Site safeguard

| a | Reduce collision with power lines through marking or removal of existing dangerous sections in key areas. | RSPB, NE, GBG |
| b | Reduce collision with fences through targeted marking and removal of fence lines in key areas. | RSPB, NE, GBG |

### 5 Species management and protection

| a | Complete current LIFE+ project up to 2015. Review next steps and need for continued releases. | RSPB, GBG, University of Bath, NE |
| b | Complete review of rear and release methods to pool knowledge and establish working protocols | RSPB, GBG, University of Bath, NE |
| c | Consider further intervention as necessary to improve post-release survival rates and productivity. | RSPB, GBG, University of Bath, NE |
| d | Prevent high winter mortality events by establishing capacity to clear snow from fields in emergency situations. | GBG, RSPB |
| e | Reduce human disturbance at display and breeding grounds as necessary. | GBG, RSPB |
| f | Develop effective and targeted predator management within key areas. | GBG |

### 6 Reserve acquisition/management

| a | Consider management for great bustard within management of current and potential RSPB reserves in Wessex. | RSPB |

### 7 International

| a | Develop links with key European organisations/researchers/projects to increase understanding of working protocols. | University of Bath, RSPB, GBG |
| b | Develop UK work in context of EU action plan, report and review as necessary. | RSPB |
| c | Maintain positive relationships with organisations in Russia, particularly Saratov region, and ensure positive contribution towards in situ bustard conservation measures there. | GBG |

### 8 Communications and public affairs
a Promote great bustard as a flagship species for chalk grasslands and extensive farming. GBG, RSPB, NE

b Promote and enhance people engagement opportunities around great bustard sites. GBG, RSPB

6. REFERENCES


www.greatbustard.org
Action A2: Develop a release strategy for the project period

2. Introduction

Actions A2 and B2 are inextricably linked; the team were tasked with undertaking a thorough assessment of the potential effects of releasing bustards from additional areas. The purpose was to identify whether releasing birds from additional release sites would be beneficial, and if so, suitable locations would be investigated and any necessary permissions obtained. The aim was to establish this site in time for Year 2 release in September 2011. It was envisaged that an important step in this process would be the lease of relevant land and fencing of the site – following the already established set up at the current release site.

As well as leasing land, we were to seek additional blocks of land of key importance for displaying or ‘lekking’ males and nesting and brood-rearing females, to act as ‘management areas’ for great bustards. Like the release sites, these would be carefully managed to maximise their value to bustards, however, these would not be
fenced and several areas already established by the partners as Nature Reserves had been suggested.

By March 2011, all LIFE project staff had been recruited and the full team began work on Actions A2 and B2 in April.

During the Phase 1 years of the reintroduction project, birds released at the current site that had survived the winter returned the following spring; with males establishing a lek site either inside the fenced area or very close by. It was agreed that a second release site would not purely be for releasing birds, but that it had a dual purpose of providing safe breeding habitat. This meant that any new site would need to be managed throughout the year, with the intention that birds released there would see the site as ‘home’, creating a new focus for this population.

2.1 Method of fencing: permanent or temporary structure

In order to maximise the habitat for bustards and create a model that could be followed by other landowners, we felt that we should be concentrating on the ‘farm scale’ for another site, not a small patch of land. However, a large permanent fixed structure, similar to that at the current release site, would be less acceptable to a landowner or farmer. It would also need an electric current to be maintained, and mean that use of herbicide would have to fit in with the farming system. These issues would be hard to overcome and would limit the choices of location available. Due to this we planned to use temporary fencing at any new site, which would have the advantage of allowing a much larger area to be utilised, creating a secure site, but one where the fencing could be removed once release was over, and deployed again where required to protect nesting females. We also required the ability to undertake predator control, specifically just before releases and the breeding season, to complement control undertaken by the landowner.

2.2 Nature of Agreement

We have the capacity for an agreement with a landowner over the next four years, to manage an area, or several areas of the farm for bustards. This could take the form of a Management Agreement which clearly sets out the expectations of the Great Bustard reintroduction project, what the project would offer, what the farmer would be expected to do, the term and the payment. It would need to contain detail regarding such things as shooting activity at key times of year, reduced inputs to crops at nesting time and the management regime of suitable habitats. We would seek to ensure that the costs of provision and management of habitat was covered by
an ELS/HLS agreement, but any management activity over and above that outlined within an HLS agreement could be paid for by the project. The agreement area would be a ‘model’ for bustard management.

2.3 Bustard habitat

Habitat created for great bustards would need to take the form of a ‘patchwork’ of fallow, winter wheat, oil seed rape, grass and lucerne, so that the year-round requirements were met on the farm. This could take the form of strips or plots of crop, or individual field-scale crops depending on the size of farm. The ideal size of different bustard habitats still needs to be determined. Birds would be released into a temporary fenced area of oil seed rape, as this crop appears to be the key to attracting birds over winter. During April and May, farm inputs would need to be reduced in areas where bustards were nesting and this payment might need to be paid by the LIFE project or, preferably, an option within Environmental Stewardship could be developed that would be drawn upon where a nesting bustard was present on the farm.

During the team trip to visit the Austrian great bustard LIFE project in April 2011 we found that great bustards are breeding mostly in winter wheat, and need an adjacent strip of fallow. The fallows are left for seven years, and contain many different mixtures, usually including lucerne. In Austria, farmers are not allowed to use any sprays in the winter wheat fields between April 20th and harvest and winter wheat must be grown in three of seven years, with a forage mustard crop grown three times within the same period. Forage mustard is important in spring as it is full of insects. Organic farming appears more prevalent in Austria, weed pressures are less and there is less rainfall – 35cm per year compared to 87cm in England. Many crops are drilled on average two weeks later than in the UK and weeds do not re-grow so easily, under the summer drought conditions. Bustards do not use maize, it has intensive management and creates large areas that are unavailable to bustards. Stubbles are ploughed in directly after harvest. Generally chemicals are not used, with ploughing being preferred as a weed control.

Following this trip and meetings with Natural England, agri-environment options have been assessed and an advisory leaflet prepared for farmers. However, many of the current options are for other species and we need to be able to test options for great bustards within the farmed landscape. Therefore if the new release site was on
a farm already in Environmental Stewardship, this would give us the flexibility to develop and test habitat options for bustards.

3. Site selection criteria

In choosing a new site we considered that the distance of a new site from the current site might require temporary quarantine facilities to be constructed at the new site; birds had not been quarantined at one location and released at another, therefore it was unknown whether the released birds might return to the quarantine area. In addition, in previous years the UK great bustards have shown a south-west movement during winter. This is observed in Saratov, however here it is thought to be linked to severe weather conditions. Although the winters experienced in the south-west of England are very much milder than Russia, the same SW movements have been undertaken by some of the birds released in the UK (see below).
3.1 Site selection criteria

Seven sites were assessed against key factors known to be important for great bustards. Each area was visited by the project team, and viewed from public byways and roads. This provided information to identify initially suitable sites based on the primary criteria below. LIFE project staff from the University of Bath then undertook a mapping exercise to identify power lines, and carried out detailed analyses of topographical features, density of man-made features, habitat, and the usage of areas by other great bustards, making a comparison between all seven sites and including the current site. Having identified the most suitable sites, secondary information was then collected following introduction and visit to the landowner and farm.

Primary criteria

1) Overhead power lines: as well as the risk of collision, there is also good evidence from the Austrian project that power lines can create barriers to movement of bustards

2) Landscape: open, large fields with few hedgerows and few woodlands, good mix of crops and grass (also applies to other farmland surrounding the site/farm)

3) Disturbance: footpaths, byways, bridleways, game strips indicating shooting activity

4) Distance and direction from the current site: most sightings have been within 20km

5) Number of records of great bustards at or around the site

6) Is the farm in an agri-environment scheme: obvious wide field margins, fallow plots, strips of wild bird seed mix etc. Organic or conventional farm?

7) Landowner/land manager: do we already work with them?

Secondary criteria

a) Do they control foxes and would they be happy to increase control if needed

b) Level of game bird shooting activity and areas covered

c) Current mix of crops; do they grow rape (many organic farms do not)

d) Are there any site designations; SSSI, SPA, AONB, SAMs.
LIFE+ Project “Reintroducing the Great Bustard Otis tarda to Southern England (LIFE09/NAT/UK/020): Year 1 Summary

- Distance from site to other locations known to have been visited by bustards
- Proximity to built-up areas and roads

3.2 Assessment of proposed additional release sites

**Summary**
A comparison of the topographical factors, land cover, density of man-made structures and frequency of birds visiting the seven proposed additional release sites and the present release site was performed. Although sites 2 and 8 are higher in elevation than the other five sites, site 1 has a significantly greater average slope inclination than all other sites, with a greater calculated Ruggedness Index. All sites show a roughly SE-facing direction on average, similar to the average aspect of the area.

Sites 1, 3 and 5 all have pylon structures, with the site 3 pylons covering a distance of more than 350m. Site 8 has the lowest density of buildings and also the lowest total length of roads and tracks.

The highest proportion of arable cereal habitat type was at sites 3, 4 and 7, with sites 1, 5 and 6 having higher proportions of calcareous and improved grassland.

After site 1, site 3 has had the highest number of visits from bustards. All factors were ranked to give an overall rank, suggesting that site 3 is the most suitable of all proposed additional release sites, closely followed by site 8.
1. Introduction

The principal objectives of a reintroduction project are to establish a viable, free-ranging population in the wild, of a species which has become globally or locally extinct in the wild. Our aim is to establish two neighbouring founder populations, increasing the chance of establishing a viable and self-sufficient population, where there might be interchange between the two populations and higher levels of genetic diversity (Williams & Scribner 2010). The mid-term review highlighted survival over the first winter after release as the primary limiting factor to the success of the reintroduction project, therefore the introduction of a second release site, given greater knowledge of their ecology in the UK, may allow us to boost survival during this critical period.

The Great bustard is a ground-dwelling steppe bird inhabiting lowlands, river valleys and open country areas of the Palaearctic region (del Hoyo, Elliot, & Sargatal 1996). Terrain with gentle undulations is preferred (Suarez-Seoane, Osborne, & Alonso 2002), with nesting females selecting slopes orientated towards the southwest with good horizontal visibility, giving protection from cold and wet north-westerly winds and increasing detection of predators or disturbances (Magaña et al. 2010).

The habitat preferences of Great bustards are seasonal, greatly depending on breeding behaviour and food abundance and as patterns of habitat selection change through the year (López-Jamar et al. 2010; Moreira et al. 2004), a mosaic of habitats is essential. The most important to habitat types across Europe and Russia are: fallow (winter and breeding season (López-Jamar et al. 2010; Moreira et al. 2004)), stubble (all seasons (Lane & Alonso 2001)), cereal crops (all seasons (Magaña et al. 2010; Morgado & Moreira 2000)), alfalfa or lucerne (all seasons, especially winter (Lane, Alonso, & Martin 2001; Martínez 1991; Peris et al. 1992)). Moreira and colleagues (2004) recommend that the priority for habitat management is the maintenance of suitable display areas (fallow fields, in particular) and cereal fields near lek areas, which are important for nesting females. Great bustards have been shown to avoid forested areas, with afforestation being implicated in the extinction of Portuguese leks (Pinto, Rocha, & Moreira 2005), and built-up areas, where there are sources of disturbance or danger, such as roads and power lines (Lane et al. 2001; Pinto et al. 2005). Habitat, however, is only one of two factors identified as being important determiners of Great bustard distribution. In Europe, Great bustards are apparently not limited by habitat availability, but show fidelity to sites that are already occupied...
by bustards (Lane et al. 2001; López-Jamar et al. 2010); therefore, settlement may be affected by philopatry, the presence of conspecifics and habitat cues.

At the beginning of the project, the Ministry of Defence Salisbury Plain Training Area (SPTA), an area of c. 38,000 ha used by the military and covered by an integrated management plan for wildlife, was identified as the best area to release Great bustards in the UK. The SPTA is a large area of protected calcareous grassland, similar to the favourable lekking grounds in Portugal and Russia (Osborne 2005), with areas of cereal crops surrounding the central grassland. Salisbury Plain's rough grasslands were considered to provide sufficient food for rearing chicks, but if other areas are used for breeding, habitat management plans such as ‘set aside’ and unsprayed ‘conservation headlands’ may also achieve similar levels of invertebrate diversity (Denys & Tscharntke 2002).

Here, a set of possible second release sites were chosen by local experts and assessed according to key factors is important for Great bustard habitat selection and compared to the long-term release site to select a single second release site where birds will be released in Autumn 2011.

2. Methods

For each proposed release site and the present release site, central coordinates were used to create buffer regions with a 2 km radius around the central points. Within these buffer regions the area of buildings, length of power lines (from Ordnance Survey MasterMap data provided by Edina under licence; URL: http://edina.ac.uk/) and total length of major and minor roads (from Ordnance Survey Strategi data) were calculated using Quantum GIS (URL: http://www.qgis.org/).

Ordnance Survey Landform Profile data (1:10000) was used for elevation mapping and using the QGIS Raster-based terrain analysis plug-in (M. Hugentobler, 2011), mapping of terrain slope, aspect and Ruggedness Index was performed. Slope was calculated with the first order derivative of the elevation at a location, to determine the steepness relative to the 8 surrounding pixels, giving degrees of inclination with a minimum value of 0 degrees and a maximum value of 68.132 degrees. Aspect is given in degrees of cardinal direction related to the direction that the land is facing, with 0 degrees as North, 90 degrees as West, 180 as South, and 270 degrees as East. For example, 225 degrees would represent land with a South-East facing aspect. Ruggedness Index (Riley et al. 1999) is a measure of terrain heterogeneity, calculated by summarising the change in elevation within a 3×3 pixel grid. To provide an
assessment of the terrain in each of the site buffer regions, thirty randomly-selected coordinates were sampled within each buffer region.

To provide an estimate of the topographical variables across a wider region, twenty samples were taken at regularly-spaced intervals in a grid across a 30km by 20km region covering the area where the sites and buffer regions were located. Using GLMS with a quasi-poisson error structure in R (v.2.12.1; URL: http://cran.r-project.org/) elevation, slope, aspect and Ruggedness Index were compared between sites.

Centre for Ecology and Hydrology Landcover map 2000 data (Fuller et al. 2002) was used to calculate the total hectares of broad-scale habitat types (Level 2 data) within the 2km site buffer regions. The proportions of total area covered by six important habitat types for bustards was then calculated and compared between sites. LCM2000 is a thematic classification of spectral data recorded by satellite images from the Landsat sensor, calibrated by field survey data (URL: http://www.ceh.ac.uk/LandCoverMap2000.html).

Re-sighting and PTT data covering the period from 27\textsuperscript{th} August 2005 to 27\textsuperscript{th} May 2011 were intersected with the 2km site buffer regions to give totals of records for each site by month.

3. Results & Discussion

3.1 Topographical factors

Elevation across the area was on average higher than the mean elevation of the sites (ESP=197.6m±26.2; Sites=134.2m±2.67). Between sites, 1, 3, 4, 5 and 7 were of significantly lower elevation than the average, with 2 and 8 being significantly higher (GLM with quasi-poisson errors: Site: $F_{7,240}=60.4$, $p<0.001$***; Figure 1a).

The ESP area was less steeply sloping on average than the sites (ESP=3.2°±0.54; Sites: 4.5°±0.22). Between sites, 1 was significantly steeper than the average across all sites (GLM with quasi-poisson errors: Site: $F_{7,240}=2.1$, $p=0.04$*; Figure 1b).

On average, the ESP area had a South-East facing direction; the aspect of the sites also showed a similar aspect on average (ESP=197.6°±26.1; Sites=184.2°±6.54). There was no significant difference between the aspect of the sites (GLM with quasi-poisson errors: Site: $F_{7,240}=1.21$, $p=0.3$; Figure 1c), however site 6 showed a slightly more easterly-facing aspect than the other sites on average ($t=2.4$, $p=0.02$*).
Ruggedness Index suggested that the ESP area was relatively level (ESP=1.4±0.24) and slightly less rugged than the average across all sites (Sites=2.1±0.09). Between sites, there was a marginal difference in Ruggedness Index (GLM with quasi-poisson errors: Site: F$_{7,240}$=1.9, p=0.06; Figure 1d), with site 1 showing a higher average Ruggedness Index than the other sites (t=3.1, p=0.002**).

Figure 1. Comparison of topographical measurements between sites: (a) elevation, (b) slope, (c) aspect and (d) Ruggedness Index. Present release site shown as open bar. Error bars displayed are ±1 S.E.
3.2 Land cover and broad-scale habitats

The proportions of land covered by six different habitat types important for bustards are shown for each release site in Figure 6. Sites 3, 4 and 7 had the greatest proportions of the arable cereals habitat type (Figure 6a), followed by sites 2 and 8. The lowest proportions of arable cereals were at 1, 5 and 6. Sites 1, 5, 6 and 8 showed high proportions of calcareous grassland (semi-natural grassland with pH > 5.5; Figure 6c) and improved grassland (dominance of palatable grasses; Figure 6d). Generally, woodlands were not a dominant habitat within the buffer regions (Figures 6e and 6f).

Figure 6. Proportion of total area of land cover types within 2km release site buffer regions. Panel (a) shows total areas of arable cereals, (b) arable horticulture, (c) calcareous grassland, (d) improved grassland, (e) broad-leaved/mixed woodland and (f) coniferous woodland from LCM2000 data.
3.3 Man-made features

Five sites do not have any pylon structures present in their buffer regions: sites 2, 4, 6, 7 and 8. Sites 1 and 5 have less than 50m length of pylon structures, whereas site 3 has more than 350m of pylon structures (Figure 3a). The suggested South-West movement of Great bustards after release in the UK (J.Burnside unpublished data) may be influenced by the configuration of the pylons in this region (Figure 4).

Sites 4, 5 and 6 have the highest total area of buildings within their buffer regions (Figure 3b). Sites 1, 2, 3 and 7 have a comparably lower total area of buildings, with site 8 having the lowest total area of buildings.

![Figure 3. Total length of power lines (a) and area of buildings within buffer regions (b), separated by site. Present release site shown as open bar.](image)

A-roads are present in five of the site buffer regions; sites 2, 7 and 8 do not have any A-roads within their buffer regions (Figure 5a). Site 5 has the greatest length of B-road compared to all other sites (Figure 4b) and site 6 has the greatest length of Minor roads (Figure 4c). When all path, tracks and roads were included, the highest values were found at sites 4 and 5, with sites 2, 3, 6 and 7 having roughly a third less total length (Figure 5d).
3.4 Usage of sites by Great Bustards

Radio-tracked juveniles in four areas of Spain showed an average dispersal distance of 15km from their natal site, ranging from 0.14km to 178.42 km (Martín et al. 2008). Natal dispersal distances were larger in males than females (Males: mean=21.2km, n=45; Females: mean=8.8km, n=45).
Bustards are recorded to have visited sites other than their present release site, site 1: sites 3, 4, 5, 6 and 7. No bustards have been recorded at sites 2 or 8. The total numbers of records from re-sighting and PTT data for sites is shown in Figure 7. Visits to sites other than site 1 were variable across the year, with much of the data being from a small number of birds.

However, the number of different birds producing these re-sighting and PTT records are few (Figure 7); the 2km buffer region around site 3, despite having the highest frequency of visits, has only been visited by a total of four birds (O15, P5, P6 and Y7). In comparison, site 4 has been visited by two birds (P5 and P6), site 5 by one bird (B3), site 6 by one bird (PK15) and site 7 by one bird (G1).

Figure 7. Visits by bustards to 2km site buffer regions. The top panel shows the total number of records of bustards from PTT data (open bars; PTT) and re-sighting data (filled bars; RES) from 27th August 2005 to 27th May 2011 by site number. The bottom panel shows the total number of identified individuals visiting these sites across the same period. Site 1 excluded due to bias of being present release site.
3.5 Summary rankings

To give an overall estimation of the suitability of the proposed sites as release sites, sites were ranked according to man-made features, topographical factors and bustards recorded (Table 3). The most suitable sites according to the ranking system used were 3, 8 and 1. If the bird data is excluded from the overall ranking, the top site is site 8, with sites 2 and 3 jointly second, followed by sites 7 and 1.

Table 3. Summary of sites according to man-made features, topographical factors, and bustards recorded. Sites are ranked, with best site as 1, through to the worst site, 8. Total score gives the sum of the rankings, with the site suitability being higher the lower the overall rank.

<table>
<thead>
<tr>
<th>Site number</th>
<th>Man-made features</th>
<th>Topography</th>
<th>Bustards</th>
<th>Overall rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length of power lines</td>
<td>Roads, tracks and paths</td>
<td>Area of buildings</td>
<td>Slope</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>8</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>7</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>5</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>6</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>
References


### 3.3 Visits by bustards to site 3 and local vicinity

Following the above assessment, the following information was collated for site 3.

**Records from PTTs**

Table 1. Time spent at site 3 and vicinity split by season from PTT data (26.09.2007 to 27.06.2011).

<table>
<thead>
<tr>
<th>Bird ID</th>
<th>Number of days present</th>
<th>Total number of days alive since release (*to 27.06.2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>January - March</td>
<td>April - June</td>
</tr>
<tr>
<td>P6</td>
<td>3</td>
<td>76</td>
</tr>
<tr>
<td>P5</td>
<td>3</td>
<td>81</td>
</tr>
</tbody>
</table>
Table 2. Number of observations at site 3 and vicinity split by season from re-sighting data (27.08.2005 to 27.06.2011).

<table>
<thead>
<tr>
<th>Bird ID</th>
<th>Number of observations present</th>
<th>Total number of observations in vicinity</th>
<th>Total number of days alive since release (*to 27.06.2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>January - March</td>
<td>April - June</td>
<td>July - September</td>
</tr>
<tr>
<td>G6</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>O15</td>
<td>3</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>P5</td>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>P6</td>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Y18</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Y22</td>
<td>0</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Y7</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Unidentified</td>
<td>7</td>
<td>56</td>
<td>2</td>
</tr>
</tbody>
</table>
B2: Lease land for additional release sites and management areas

1. New Release Site

Following this assessment “Release Site 2” was chosen as an additional release site, as a one year trial for 2011. Our assessment found that of the seven potential sites, this farm has received the highest number of visits by bustards (see assessment of records above). These visits were throughout the year, and by birds from different years. In addition, it is known to regularly attract Orange 15, the oldest currently surviving female, released at Release Site 1 in 2004. This would be a bonus for any young bustards released here.

2. Landowner agreement

The landowners agreed to a ‘trial’ year where one field would be entirely fenced and would contain temporary release pens. They also agreed that the project staff could have access to all areas (by permitted routes) in order to monitor the birds post-release. The farm does operate a game bird shoot, and project staff requested to liaise with the gamekeepers regarding these dual operations on the farm. Permission was granted for staff to undertake night-time predator control work to control foxes on site; this would be undertaken by the Director and Project Officer of the GBG who have firearms licenses. The field chosen for the release was rented by the grazier, to grow stubble turnips and fodder rape as winter forage for his sheep flock. This was offered to the project as it would not require any field operations until January when the sheep would need to graze it. This location suited the project perfectly, as the field had a high point with a good view in each direction.

3. Fencing the new release site

After fully researching the options available, we decided upon a product promoted as the best deterrent to foxes; electrified poultry netting. This stands at 112cm high and consists of a 50m length of netting with double forked flexi-poles at 1m intervals along its length to give greater stability in windy conditions. As an extra precaution, we also deployed a single strand of electric steel cable around the outside of the net at a distance of 20cm from the netting and 10cm above ground height.

Soft release pens were constructed on top of the growing crop of stubble turnips and fodder rape. The topography of the release field is such that running west to east it is highest in the centre, sloping down either side. The pens were positioned at the highest
part of the field with doors facing west. As an extra protection and to stop predators from trying to dig underneath the pens, two 50m lengths of poultry netting were joined together and erected around the outside of the pens at a 2m distance with a single steel wire around the outside of the net, located at 10cm above ground.

4. Assessment of new release site usage and success

4.1 Initial post-release survival

In 2011, sixteen birds were released at Release Site 1 (12 females, 4 males) and thirteen were released at Release Site 2 (7 females, 6 males).

Compared to previous years, birds released in 2011 showed slightly higher survival from release to 60 days post-release than average (Kaplan-Meier survival model - 2011: 57.1% ± 9.3%; 2004-2009: 47.0% ±13.5%). Those released at Release Site 2 had significantly higher survival to 60 days post-release than those released at Release Site 1 (Kaplan-Meier survival model – Release Site 1: 40.0% ±12.6%; Release Site 2: 76.9% ±11.6%; Figure 1). However, these estimates are based on carcass recoveries; over this 60-day period there was a decline at both sites in the number of birds observed on a
daily basis, therefore there is a possibility that birds not observed may have died. From release to 15th December 2011, thirteen birds of twenty-nine released in 2011 were recovered dead.

Predation was the main cause of death of birds at Release Site 1 (67% of 9 birds), with collision-related injuries resulting in comparatively fewer deaths (11%); 22% of deaths were difficult to classify and may have been due to either predation, collision or collision followed by predation.

At Release Site 2, there were four carcasses recovered: two were collision-related injuries, including at least one with power lines, one was caused by entanglement with the release pen fence, and one may have been due to either predation, collision, or collision followed by predation.

4.2 Behaviour of released great bustards at the release sites in 2011

In 2011, all young great bustards spent one week in soft release pens within their release sites. Each pen was 20 feet square and 5 feet high, and contained between four and six birds. On the day of actual release, one panel of each pen was opened, to allow the birds to leave the pens in their own time. In the first few weeks after release, movements at both sites tended to be short distance. Birds tended to linger around or within the pens, until the doors were closed and ultimately the pens were removed. When they did move, they exhibited a strong desire to return to the other birds. After a flight, the normal behaviour seemed to be to attempt to walk back to the other birds.

Figure 2 shows the usage of the areas around the two release sites.
Release Site 1

The relatively small size of the release site, and particularly its narrowness, meant that any short practice flight in a northerly or southerly direction resulted in birds landing outside the pen. The instinctive reaction to try to walk back was confronted by one or several fences. Birds were often found pacing either barbed wire fences or the fence of the pen itself, and as a result were extremely vulnerable to predation. In the first few weeks, they always required help to return to the pen, either by encouraging them to fly back or by shepherding them through an open gate in the pen. Several mortalities in this period were of birds which spent at least some of the night in vulnerable positions. The height of the pen fence (2m) also posed a problem to birds still developing their flying abilities. Two birds were killed due to collisions with the pen fence.

Release Site 2

The same behaviour had different consequences at this site. Importantly, it was about three times bigger, accommodating many of the early practice flights without leaving birds outside the fenced area. However, birds still often ended up outside the fence and tried to walk back. With fewer fences on the farm, it was easier to reach the electric fence surrounding the release area, but the birds were often found pacing this fence line. One bird died as a result of becoming tangled in the fence, trying to get back to the other birds inside. There were no other fence-related mortalities – the electric netting was only 1.1m high and did not appear to pose any risk from collisions. In response to the
situation, project staff opened gaps in the electric fencing during the day, when the likelihood of fox activity was thought to be low. This allowed birds which flew out of the pen during the day to return on foot without any human intervention. Birds outside the pen at the end of the day were encouraged to return, before the gaps were closed for the night. The flexibility afforded by temporary fencing was a definite advantage in this situation, allowing birds to behave fairly normally during the day, but providing security at night.

4.3. Initial assessment of fox populations at the release sites

A preliminary assessment of Red fox (*Vulpes vulpes*) density on Release Site 1 has suggested that the highest density is in the valley where the release pen is situated (A. Weldon, pers. comm.). This may be due to a high density of the main prey species of the Red fox, European wild rabbit (*Oryctolagus cuniculus*), but it may also be related to the topography of the landscape. The majority of the carcasses recovered from around the Release Site 1 since 2004 have been in the valley where the release pen is situated (Figure 4); this valley may act as a corridor facilitating the movement of foxes (A. Weldon, pers. comm.). Initial camera surveys at both release sites recorded proportionally more images of foxes at Release Site 1 than at Release Site 2 (Figure 3).

<table>
<thead>
<tr>
<th>Release Site 1</th>
<th>Month</th>
<th>Number of fox recordings</th>
<th>Number of Camera nights</th>
<th>Date monitoring started/finished</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>October</td>
<td>11</td>
<td>66</td>
<td>10/10/2011</td>
</tr>
<tr>
<td></td>
<td>November</td>
<td>24</td>
<td>150</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Release Site 2</th>
<th>Month</th>
<th>Number of fox recordings</th>
<th>Number of Camera nights</th>
<th>Date monitoring started/finished</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>October</td>
<td>3</td>
<td>66</td>
<td>10/10/2011</td>
</tr>
<tr>
<td></td>
<td>November</td>
<td>8</td>
<td>103</td>
<td>22/11/2011</td>
</tr>
</tbody>
</table>

Figure 3. Results of camera surveys at both release sites during October and November 2011.
5 Comparison of potential release sites for 2012

Release Site 1

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Project and project staff based at site</td>
<td>1. High initial post-release mortality related to:</td>
</tr>
<tr>
<td></td>
<td>i. Dense fox population; site topography is advantageous to predators</td>
</tr>
<tr>
<td></td>
<td>ii. Collisions with fences, including release pen fence and barbed wire fences</td>
</tr>
<tr>
<td>2. Release pen rented by project and already managed for bustards throughout the year; therefore suitable for mid-summer release</td>
<td>2. Livestock farm; fences restrict the movements of young newly-released bustards; removal often not possible</td>
</tr>
<tr>
<td>3. Facilities for visitor trips, income generation and project promotion</td>
<td>3. Topography of the site is disadvantageous to the movements of young newly-released bustards</td>
</tr>
<tr>
<td>4. Small established population; one female likely to breed in the area in 2012 and only known mature male; birds released in 2011</td>
<td>4. Usage of designated and managed release pen is not uniform; birds prefer small area of pen</td>
</tr>
</tbody>
</table>
surviving to 2012 release

5. Low disturbance; restrictions on public access to MoD land
6. Abundant semi-natural grassland in close proximity
7. Releasing here would avoid any negative impact on public relations

5. Limitations on predator-control allowed around the site
6. Similar dispersal between release sites 1 and 2 approximately one month post-release
7. Relative lack of suitable arable habitat around release site

Release Site 2

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Site topography flatter; more suited to young newly-released birds</td>
<td>1. Limitations on predator-control allowed around site</td>
</tr>
<tr>
<td>2. Higher 30-day post-release survival; greater social cohesion between released birds</td>
<td>2. Conflict with gamekeepers concerning disturbance to gamebirds</td>
</tr>
<tr>
<td>3. Older female frequenting site and associating with newly-released birds; birds released in 2011 surviving to 2012 release</td>
<td>3. Power lines in close proximity to release site in 2011; at least one death caused by collision with power lines</td>
</tr>
<tr>
<td>4. Arable farm; few fences around release area and possibility of removal of fences</td>
<td>4. Similar dispersal between release sites 1 and 2 approximately one month post-release; low number of re-sightings in vicinity; survival of birds after movement away from site not well-understood</td>
</tr>
<tr>
<td>5. Predator-control carried out by gamekeepers; lower fox densities</td>
<td>5. Release site in 2011 did not offer variety of habitats; monoculture may have encouraged dispersal</td>
</tr>
<tr>
<td>6. Flexibility offered by temporary fencing around release site; possible to fence a larger area</td>
<td>6. Management agreement not yet in place; this would be required to release birds at this site in August</td>
</tr>
<tr>
<td>7. Suitable arable habitat in all directions; availability of semi-natural grassland</td>
<td></td>
</tr>
</tbody>
</table>

Release site 3: Unspecified

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Possible to find more suitable topography and habitat for newly-released birds, encouraging greater site fidelity over initial post-release</td>
<td>1. Short time scale for decision on where a new release site will be; little time for agreement with landowner to be worked out</td>
</tr>
</tbody>
</table>
### 6 Options for release in 2012

The following options are based on the assumption that in 2012 we will import 50% of great bustards as eggs and 50% as chicks. This will create two release periods, one in August for those imported as eggs, and one in September for those imported as chicks. Correct habitat provision and management to cater for birds released at these different times will be more difficult in locations where we do not rent the land. For the purposes of this document, we assume that 20 young bustards will be released in each of two release periods. If one release site were used, 20 individuals would be released in each release period. If two release sites were used, 10 individuals would be released at each site in each release period.

There are four options to consider:

1. Release birds at Release Sites 1 and 2
2. Release birds from one site at Release Site 2
3. Release birds from two sites at Release Site 2
4. Release birds at Release Site 2 and a new release site

The possibility of releasing birds at more than two sites is not considered. This approach would pose challenging logistical problems, both for pre-release management and post-release monitoring. In addition, we will not fully understand how successful the release at Release Site 2 in 2011 has been, in terms of survival, until spring 2012.

**Option 1: Release birds at Release Sites 1 and 2**

Birds released at Release Site 1 suffer high initial post-release mortality from fence-related injuries and predation. For birds to be released here in 2012, changes would need to be made to the structure of the release pen and local fencing to allow birds to return to the release pen without difficulty. We would also need much greater ability to perform predator control independently through lamping and snaring.

Alternatively, the fixed release pen could be abandoned for 2012 and birds released from a temporary fenced area elsewhere on the farm. This would be best located in the area south of the release pen which older birds frequent, presumably due to its topography and habitat. It would require additional land to be rented from the landowners, which might be prohibitively expensive.

If a management agreement to create habitat suitable for releasing bustards in August at Release Site 2 were not possible, Release Site 1 would be the only site with an agreement already in place, for releasing birds hatched in the UK. Release of birds imported as chicks could still take place at Release Site 2 in September, using a similar approach to 2011.

**Option 2: Release birds from one site at Release Site 2**

In order to release birds at Release Site 2 in 2012 we would need to set up a management agreement with the landowners to enable us to create habitat suitable for the release of birds in August and September. A management agreement on a field-scale would be required to maintain the advantages of the field-scale approach to the release trialled in 2011.

As the farm is mainly arable, fence removal, if necessary, around the chosen site should be considered as part of the management agreement. Predator control should also be a fundamental part of any agreement. Releasing birds at one site within the farm would enable more resources to be directed towards making that site as attractive to bustards as possible, although a large number of birds released at once may be less effective in
creating stable ‘family’ groups. There is also a chance of causing disturbance to birds released in August through the process of releasing more birds in September.

A known risk to released birds, and a cause of mortality to at least one of the birds released in 2011, is the set of power lines within close proximity of the release area. If bustards are to be released here in future years, contact should be made with the power company to seek to mark these lines.

Releasing all the birds at Release Site 2 will present problems for income generation and project promotion through visitor trips to Release Site 1. Release Site 2 is not a suitable location to run these visits. At Release Site 1, visits may be continued through using the existing release pen as a rehabilitation site for injured birds, with the added attraction of returning adult bustards, but this will not be as strong an attraction to visitors.

**Option 3: Release birds from two sites at Release Site 2**

Birds released could be separated into two groups and released from two separate sites, perhaps at opposite ends of the farm. This could create smaller ‘family’ groups than releasing all twenty birds at each release period into the same area. It would also allow for interchange between groups when they disperse.

However, assuming the landowners are only prepared to accept a management agreement over a small area of the farm, splitting the releases over two sites would have the consequence of reducing the size of each of those sites. This would make each site less attractive to bustards, perhaps reducing survival in the immediate post-release period and increasing the chance of dispersal during the winter.

**Option 4: Release birds at Release Site 2 and a new release site**

It is too early to make a long-term assessment of the success of the new release site, although we do know that survival to one month post-release was higher. It may be too soon to make a further commitment to the area by seeking an agreement with an additional landowner.

A new release site needs to be agreed and management agreements in place by February 2012 to allow for suitable habitat to be created in time for the release periods. This means there is very little time available to approach a new landowner and reach agreement. If we define a search area within 5km of Release Site 2, there are a limited number of farms to investigate. Plans for 2012, incorporating two quarantine periods and two release periods, will place an additional burden on staff resources. A new site
may be a step too far at this point, but should be investigated in time for 2013, once the level of success at Release Site 2 is clearer.

7 Recommendations

The LIFE Project Steering Group were asked to adopt Option 2; to release all birds at Release Site 2 in 2012.

Due to the separate release times for Russian and UK hatched chicks, the single site could be managed as two to provide the correct habitat needs for younger and older chicks. However, in the long term we consider that it is better to release birds at more than one site. We should seek a Land Management Agreement with the landowners of Release Site 2, of initially one year, to repeat and assess results.

If we cannot identify enough suitable land to provide for release of both Russian and UK chicks, we should investigate the adjacent farms for this purpose; seeking a single year ‘trial’ release in 2012.

We expect to be able to make an initial assessment of the success of the Release Site 2 2011 release by April 2012. If at this point we feel able to commit to the area, we should also seek to identify a new release site from surrounding farms. A management agreement with a new landowner should be in place by autumn 2012, to allow us to create habitat at the site suitable for release in 2013.
C1: Transport young bustards from Russia to the UK

Thirty-five young Great Bustards were transported successfully from Diakovka in Russia to Heathrow airport where they were then collected by members of the project team. The collection from Heathrow took place in the evening of the 4th August 2011, using two hired Mercedes Sprinter vans; each of these vans carried three crates which the Great Bustards had been transported in for the duration of their journey. Once they had been checked over by vets and cleared by airport officials they were loaded into the vans and driven to the project site. Once at the project site, the young bustards were transferred into the quarantine unit, keeping them in the groups that they had been transported in.
C2: Carry out health checks on young bustards

Just before the great bustards are transported to the UK, health checks are carried out in Russia, including swabs and blood samples taken and checked for any viruses by the Animal Veterinary Health & Laboratories Agency (AVHLA). Once in the UK, the birds are quarantined for 30 days, where it is necessary for four veterinary checks to be carried out.

The first of the health checks in the UK took place on the 9th August with a project vet coming to collect faecal samples from within the pens. The second health check on 15th August meant catching the bustards and taking buccal and cloacal swabs from each of them; undertaken by two project vets with the help of project staff. On the 24th August two project vets took blood and faecal samples with the help of project staff. The blood samples are stored in a bio-secure pot for transportation to AHVLA. The final check was performed just before the birds were released; this was a general health check and worming. Some birds were kept back at the time of release as they were not deemed fit for release. These birds were:

BK08 – a male who broke his wing in the soft release phase, never recovered sufficiently to be re-released. Now in captivity.

BK20 – a male released as T2 with a transmitter and no wingtags, the transmitter fell off and the bird broke a toe, he was caught and brought into quarantine to be treated and then be released as BK20. During his time back in quarantine he broke a wing, which healed well enough for him to be re-released, one wing was clipped so that he would be confined to the safety of the release pen until after his first moult.

Male - Came to the UK with a broken wing, was thought to be a female and so was kept back, however the wing never healed sufficiently, and the bird turned out to be a male. Now kept in captivity.

Female – broke her wing during quarantine, never seen fit for release, now living in captivity.
Great Bustard LIFE+ Project

Quarantine and Release Schedule

August – September 2011
Introduction

Within the UK reintroduction project, the method of releasing great bustards has differed and been improved over the years. In 2009 and 2010 a form of soft release was trialled along with some birds being hard released for comparison. The results from these trials in relation to survival were inconclusive, as other parameters may have been affecting the bird’s survival but had yet to be identified or addressed.

In Year 1, we concentrated on identifying the various factors that might affect the birds resulting in poor survival. Each aspect was investigated, from rearing in Russia through to the actual way in which birds were finally released.

In Russia, once hatched chicks are moved into a small room with sand substrate and fed using a puppet resembling a great bustard, also the aviculturist wears a suit to disguise the human shape. Chicks are housed and reared together indoors for the first four weeks; the number of birds being dependent upon hatching dates. At a month of age they are then moved into two separate large outdoor pens. Just before import the birds undergo health checks when blood samples are taken, oral and cloacal swabs are taken. This is all carried out in the outdoor pen area; vets and project staff are not disguised at this point. For transport and import, birds are normally sorted into size groups, however, in 2011 the birds were all of similar size, as egg laying had occurred later and so birds were also younger.

A visit to Russia earlier in the year by vet Chris Davies from the Game & Wildlife Conservation Trust, suggested a reduction in the amount of protein in the diet. Too much protein can result in conditions such as angel wing where feather growth has exceeded skeletal growth. This would produce much leaner birds growing at a more natural rate of development.

On 4th August, 35 birds were imported. Following 48 hours of travelling via truck, plane and van, they arrived at the project site and were placed in quarantine at mid-night. The birds remained in their groups; one unit contained five birds, with six birds in each of the other quarantine units.
Quarantine & husbandry

Quarantine had been made ready following the guidelines issued for ‘Approved quarantine facility’ Commission Regulation (EC) 318/2007, and approved by Animal Health, Veterinary Laboratories Agency (AHVLA) Gloucester.

Several changes were made to quarantine this year. Small viewing windows were created to allow the birds a view of the outside. This was implemented to lessen any stress that may be caused by the enclosed space, and in an attempt to stop the birds from ‘jumping’ up to the roof netting as they have done in previous years. In addition, the walls of quarantine units were lined with thick plastic to at least one meter in height. This was to avoid feather abrasion as in previous years drop nets had been used, and occasionally birds had been seen to rub themselves on the netting and poor feather condition had been observed.

The new windows allowed staff to undertake a visual check of the birds before entering quarantine. All quarantine regulations were followed. Over-suits were put on and footwear was changed in the entrance porch and boots dipped in F10 disinfectant solution before entering the main building. This dip was replenished regularly. Staff wore quarantine suits at all times. Disinfected mats were placed at the entrance to each unit; these were regularly cleaning and soaked with new F10 solution.

A water supply had been installed for cleaning food dishes, changing drinking water and cleaning hands. All refuse was secured in black bags and stored in a cupboard for the duration of quarantine. Waste water was also stored in a large sealed container for the duration of quarantine. Hand-wash, F10 solution and nailbrushes were used to clean hands before leaving quarantine and again after leaving the unit.

The birds were fed twice per day; c.0700 and c.1700 (please see attached Appendix for food items). Food was prepared in a small unit at the end of the main building, and food dishes passed to the birds through a ground-level hatch. The only time staff went into the units containing the birds was to reach food dishes that had been moved away from the hatch, to change drinking water or to remove waste food if any had built up. In addition, this year yellow ponchos were worn when providing ‘treats’ such as mice or mealworms to the birds. This method was introduced following similar practices by the Brandenburg great bustard project, with the intention of gaining trust of the yellow poncho so that during the soft-release stage and actual release, the birds would be easier to approach.
Soft-release pens

Following 30 days in quarantine, the birds require a period of adjustment to the surroundings, to adapt visually to the immediate landscape, to see older bustards in the vicinity, to gradually be weaned off their quarantine food and to ‘home’ to the site. This year a new design of soft-release pen was used, different in material and size and location. Another action this year was to identify a second release site. This would necessarily be on private farmland and to facilitate this, the form of release pen had to be easy to erect and remove, being of very temporary design, yet providing enough space for a short period whilst being small enough to stop flight into roof or sides at speed. Pens used by pheasant breeders were adopted (courtesy of GWCT). These are wooden framed with small gauge wire mesh walls and with 30cm boards at the base running the length of each panel. Each panel measured 3m in length by 1.5m in height. The panels were joined together using wire ties, at corners the structure supported itself but 2m wooden posts were needed for support along sides where two panels met. For extra strength, three pens were linked together.

To house six birds in each pen, each was constructed using two panels per side; 6m x 6m, providing an area of $36m^2 = 6m^2 - 7.2m^2$ per bird (great bustard wingspan ~ 1.8m).

The roof covering was made of black netting; the material is of close weave silky texture so that things are not easily caught in it. Three 2m wide and 18m lengths were stitched together, and this was pulled over the pens and fixed to the wire sides with ‘S’ clips.
Soft-release pens at Release Site 1 showing panel design and fine roof netting

Electrified poultry netting and steel cable used to deter foxes at second release site
A new release site

Once the new release site had been chosen, the area needed to be securely fenced. After fully researching the options available, we decided upon a product promoted as the best deterrent to foxes; electrified poultry netting. This stands at 112cm high and consists of a 50m length of netting with double-forked flexi-poles along the length of netting to locate into the ground. We took advice from Rappa on how to maintain the conductivity around the whole 20ha field. The final design was 12 (50m) nets joined together with two earth stakes, one fencer battery and a 3Joule energiser, as one unit. Four of these units were required to fence the entire field. As an extra precaution, we also deployed a single strand of electric steel cable around the outside of the net at a distance of 20cm from the netting and 10cm above ground height. The fencing was installed on August 25th.

On August 26th, the block of three release pens was constructed, on top of the growing crop of stubble turnips and fodder rape. The topography of the release field is such that running west to east it is steeper in the centre sloping down either side. Inside each pen was placed a food dish and water container. The pens were positioned at the highest part of the field with doors facing west. As extra protection and to stop predators from trying to dig underneath the pens, two 50m lengths of poultry netting were joined together and erected around the outside of the pens at a 2m distance. Four wooden corner posts were erected to help tighten the netting. A single steel wire was then located, at 10cm above ground and fixed with metal corner stakes and plastic fencing posts. A single 3-Joule energiser and 12v battery provided the electric.
Young great bustards in soft-release pens at the second release site, in this view most of the electric netting around the pens is invisible

At Release Site 1 on 29th August, a similar block of three pens was erected in the centre of the release enclosure but close to the lek site. These pens did not require extra security, as there is a 2m high electric fence permanently in place around the 7ha enclosure.

At both sites, the pens were constructed on top of growing winter crops preferred by great bustards. At Release Site 1, each pen had a 1m wide strip of oil seed rape, the rest being lucerne. At the second site the pens were on top of a mixture of 1/3 fodder rape and 2/3 stubble turnips.

An automatic feeder was placed a few meters from the pens and set to distribute layers of pellet food twice per day. In addition, several plastic bustard decoys were situated near to the feeder. It was hoped that the combination of these three things, would result in the birds remaining in the release areas for longer, and, with the protection of perimeter fences, and therefore increase their survival.
Movement of birds into soft-release pens

The rate of pre-release survival, from import to release has been 88% (J.Burnside 2010), so we were expecting 30 birds to be available for release.

Two of the young birds died within four days of quarantine; post-mortem results found no diseases and death due to stress of journey was presumed. During week two of quarantine, one bird was found to have a compound fracture to its wing and had to be euthanased. Two others were found to have minor wing fractures that meant they could not be released. This resulted in 30 birds fit for release.

We applied to DEFRA on 5 September to release the birds. Official permission was received on 6 September.

On September 7th all identification devices were attached (see Appendix) and the birds were transported from quarantine to the release pens. This involved two trips to each site, using large animal carriage boxes containing three-four birds in each box. During this day photographs were taken of wings and tails of each bird; these proved that the feather condition of the birds was much better than in 2010, and that the improvements made to quarantine had worked.

The soft-release pens held 16 birds at Release Site 1 and 14 birds at the second release site. The birds were maintained in the same groups that had been together in quarantine. Once in the soft-release pens, the birds were provided with water and food for a maximum of seven days. The birds received the same food and same proportions that they had received during quarantine, but provisioned only once per day and using a yellow poncho. Each night that birds were in pens at Release Site 2, patrol for foxes was undertaken. The birds remained in the soft-release pens for seven days.

Every day that the young birds were in the soft-release pens at the second site, an older female Orange 15 (released in 2004) was present very close to the pens. From flying to another field on day one, by day seven she would hide among the decoy birds while food was delivered to the birds in the pens. At Release Site 1, two older males Purple 5 (2007) and Pink 2 (2010) were always present while the young birds were in the pens, but they stayed at a distance. During the seven days, the young birds made good use of the rape growing in the pens; so much that half way through the week, rape from outside the pens had to be picked and put in with the food dish. At Release Site 1 (which had less rape) we were supplementing rape from day 4 and the lucerne was trampled but not completely eaten by the end of the week. At the second site, one group of
females cleared ‘most’ but not all of the stubble turnips and fodder rape during the week, but both other groups left 1/3 of the vegetation.

Release Day

On September 15th the final health check on birds was undertaken. All birds were wormed and condition checked which included taking photos of wing and tail feathers. One bird was found to have a fracture in the right wing. This bird went into quarantine for treatment of antibiotics with a possibility of being released sometime later. More photographs were taken of wing and tail feathers for each bird so that comparison could be made with feather condition before the birds went into the soft-release pens. At both sites, the usual morning feed was undertaken in the yellow poncho. On release day, the food was scattered outside of the soft-release pens. Then three panels were opened up to allow the birds to leave in their own time.

At Release Site 1, the birds took their time to leave the pens and some did not come out on the first day. One bird Bk06 undertook a high and strong flight overhead on release day and on the following morning had left the site. The older males Pk2 and P5 investigated the pens and discovered the scattered food, over the coming weeks they were always either in the release pen or in nearby fields with or without some of this years young birds, but not really ever forming a close bond. The pens were left on site, but as it seemed the birds may be sheltering behind them, and occasionally going back inside, they were taken down completely after one month.

At the second site, the electric netting, steel wire, fence posts and battery had to be removed from around the release pens before the doors could be opened. This was undertaken by two people wearing yellow ponchos; everything was removed and three panels opened within 20 minutes. All of the birds came out within 10 minutes. The next morning, as all birds were no where near the pens, the doors were closed. The older female O15 joined the group of four males. At this site the pens were also left in situ, as we felt initially they would form part of the landscape that the birds associated with. After one month however, when birds were moving in and out of the release field frequently, the pens were removed. It may be a coincidence, however, that the birds at Release Site 2 dispersed from the site following this.
Results of changes made for Release No1. 2011

- Improved feather condition as a result of removing drop nets and applying plastic to the inside walls of quarantine
- Leaner birds produced from the reduction in protein to the diet provided
- Less ‘jumping’ into the roof netting as a result of windows in quarantine
- Steady and manageable birds, as a result of the poncho and age of birds on import
- All rape inside soft-release pens was eaten within four days
- The young birds stayed around the release site for one month, survival to first 60 days was greater improved at the new site: 42% at Release Site 1, 76% at Release Site 2.
- Feather condition following a week in soft-release pens: awaiting results


- Currently, the earliest that birds can be released in UK is during September due to the length of quarantine. If we explore bringing eggs back from Russia, this would allow us to release birds at an earlier age and time of learning, and at
around a month earlier in the year; this would provide the opportunity for better
development and growth before winter

- Seek permission from DEFRA for further alterations to quarantine to make more
  windows so further decreasing the stress of confinement, and to also provide a
  hospital unit
- Soft-release pen doors need to be closed as soon as all birds have left the pens
- Soft-release pens are to remain on site as their removal this year may have caused
dispersal
- Ensure that bare areas are created in the release field for
  roosting/preening/drying off
### Appendix 1:

#### Quarantine 2011 - Feeding Regime Per Pen

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Food items and amounts</th>
<th>Food items and amounts</th>
</tr>
</thead>
<tbody>
<tr>
<td>05-Aug</td>
<td>a.m</td>
<td>1 scoop Lundi 1 Lettuce 200g grated cheese</td>
<td>6 mice</td>
</tr>
<tr>
<td></td>
<td>p.m</td>
<td>1800 1 scoop Lundi 1/2 lettuce 1 pot cottage cheese 1/6 bag crickets</td>
<td></td>
</tr>
<tr>
<td>06-Aug</td>
<td>a.m</td>
<td>0800 1 scoop Lundi 1/2 lettuce 200g grated cheese 1/3 bag mealworms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>p.m</td>
<td>1630 1 scoop Lundi 1/2 lettuce 1 pot cottage cheese 1/6 bag crickets</td>
<td></td>
</tr>
<tr>
<td>07-Aug</td>
<td>a.m</td>
<td>0715 1 scoop Lundi 1 Lettuce 200g grated cheese 1/3 bag mealworms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>p.m</td>
<td>1600 1 scoop Lundi 1/2 lettuce 1 pot cottage cheese 1/6 bag mealworms</td>
<td></td>
</tr>
<tr>
<td>08-Aug</td>
<td>a.m</td>
<td>0700 1 scoop Lundi 1 Lettuce 200g grated cheese 1/3 bag mealworms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>p.m</td>
<td>1730 1/2 scoop Lundi 1 Lettuce 1 pot cottage cheese 1/3 bag mealworms 1 box rape</td>
<td></td>
</tr>
<tr>
<td>09-Aug</td>
<td>a.m</td>
<td>0700 1/2 scoop Lundi 1/2 lettuce 200g grated cheese</td>
<td>one large handful rape</td>
</tr>
<tr>
<td></td>
<td>p.m</td>
<td>1600 1/2 scoop Lundi 1/2 lettuce 1 pot cottage cheese</td>
<td>one large handful rape</td>
</tr>
<tr>
<td>10-Aug</td>
<td>a.m</td>
<td>0540 1/2 scoop Lundi 1/2 lettuce 200g grated cheese</td>
<td>one large handful rape</td>
</tr>
<tr>
<td></td>
<td>p.m</td>
<td>1630 none 1/2 lettuce 1 pot cottage cheese</td>
<td>one large handful rape</td>
</tr>
<tr>
<td>11-Aug</td>
<td>a.m</td>
<td>0645 1/2 scoop Lundi 1/2 lettuce 200g grated cheese</td>
<td>2 handfulls rape</td>
</tr>
<tr>
<td></td>
<td>p.m</td>
<td>1600 1/2 scoop Lundi 1/2 lettuce 1 pot cottage cheese</td>
<td>2 handfulls rape 1.5 small scoop Nutrobal</td>
</tr>
<tr>
<td>12-Aug</td>
<td>a.m</td>
<td>0730 1/2 scoop Lundi 200g grated cheese</td>
<td>2 handfulls rape 1.5 small scoop Nutrobal</td>
</tr>
<tr>
<td></td>
<td>p.m</td>
<td>1830 3 scoops Lundi/6 3 lettuce/6 2 pots cottage cheese/6 1/2 bag crickets/6 2 carrier bags rape/6 4 scoops Nutrobal/6</td>
<td></td>
</tr>
<tr>
<td>13-Aug</td>
<td>a.m</td>
<td>0800 3 lettuce/6 200g grated cheese/6 crickets (250 shared/6) rape/6 remaining Nutrobal/6 4 pots cottage cheese/6</td>
<td></td>
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<tr>
<td></td>
<td>p.m</td>
<td>1630 1/2 scoop Lundi 1/2 lettuce 1 pot cottage cheese</td>
<td>handful of rape 1 mouse each</td>
</tr>
<tr>
<td>14-Aug</td>
<td>a.m</td>
<td>0800 1/2 scoop Lundi 1/2 lettuce 200g grated cheese</td>
<td>handful of mealworms handful of rape 1 scoop Nutrobal</td>
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</tbody>
</table>
### LIFE+ Project “Reintroducing the Great Bustard Otis tarda to Southern England (LIFE09/NAT/UK/020): Year 1 Summary

<table>
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<tr>
<th>Date</th>
<th>Time</th>
<th>1/2 lettuce</th>
<th>1 pot cottage cheese</th>
<th>2 handfulls rape</th>
<th>1 scoop Nutrobal</th>
<th>1 mouse each</th>
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<td>15-Aug</td>
<td>a.m 0700</td>
<td>1/2 scoop Lundi</td>
<td>1/2 lettuce</td>
<td>2 handfulls cheese</td>
<td>crickets (250 shared/6)</td>
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<tr>
<td>p.m 1700</td>
<td>1/2 scoop Lundi</td>
<td>1/2 lettuce</td>
<td>1 pot cottage cheese</td>
<td>手感 of rape</td>
<td>1 scoop Nutrobal</td>
<td>1 mouse each</td>
</tr>
<tr>
<td>16-Aug</td>
<td>a.m 0715</td>
<td>bit Lundi</td>
<td>1/2 lettuce</td>
<td>2 handfulls rape</td>
<td>1/3 bag mealworms</td>
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<td>p.m 1600</td>
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<td>4+5=pot of cottage cheese</td>
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<td>手感 of rape</td>
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<td>1/2 lettuce</td>
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<td>1 carrier bag rape/6</td>
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<td>a.m 0800</td>
<td>1/2 scoop Lundi</td>
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<td>1 scoop Nutrobal</td>
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<td>19-Aug</td>
<td>a.m 0630</td>
<td>200g grated cheese</td>
<td>1/6 bag mealworms</td>
<td>rape equal to 1/2 lettuce</td>
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<tr>
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<td>1 carrier bag rape/6</td>
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<td>1/6 bag mealworms</td>
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<td>Date</td>
<td>Time</td>
<td>Action</td>
<td>Item(s) Provided</td>
<td>Mealworms</td>
<td>Rapeseed &amp; Dandelion Leaves</td>
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<td>p.m. 1630</td>
<td>Lundi top up</td>
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<td></td>
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<td>Lundi top up</td>
<td>1/2 lettuce</td>
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<td>1/6 bag mealworms</td>
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<td>p.m. 1715</td>
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<td>mice</td>
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<td>mice</td>
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<td></td>
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<td>1/2 lettuce</td>
<td>2 lettuce/6</td>
<td>1 pot cottage cheese</td>
<td>crickets (250 shared/6)</td>
<td>osr + dandelion leaves</td>
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<td>1/2 lettuce</td>
<td>200g grated cheese</td>
<td>2 handfulls mealworms</td>
<td>osr + dandelion leaves</td>
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<td></td>
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<td>1/2 scoop</td>
<td>1/2 lettuce</td>
<td>1 pot cottage cheese</td>
<td>2 handfulls mealworms</td>
<td>osr + dandelion leaves</td>
</tr>
<tr>
<td>01-Sep</td>
<td>a.m. 0700</td>
<td>1/2 scoop</td>
<td>200g grated cheese</td>
<td>2 handfulls mealworms</td>
<td>osr + dandelion leaves</td>
<td></td>
</tr>
<tr>
<td></td>
<td>p.m. 1600</td>
<td>1/2 scoop</td>
<td>1/2 lettuce</td>
<td>1 pot cottage cheese</td>
<td>1/6 bag mealworms</td>
<td>1 carrier bag rape/6</td>
</tr>
<tr>
<td>02-Sep</td>
<td>a.m. 0700</td>
<td>200g grated cheese</td>
<td>1/6 bag mealworms</td>
<td>1 carrier bag rape/6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p.m. 1830</td>
<td>1/2 scoop</td>
<td>1 pot cottage cheese</td>
<td>1 carrier bag rape/6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Time</td>
<td>Scoop</td>
<td>Type of Meal</td>
<td>Additional Ingredients</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>-------</td>
<td>----------------------------</td>
<td>---------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03-Sep</td>
<td>a.m</td>
<td>0700</td>
<td>1/2 scoop Lundi</td>
<td>200g grated cheese</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p.m</td>
<td>1630</td>
<td>1/2 scoop Lundi</td>
<td>1 pot cottage cheese</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04-Sep</td>
<td>a.m</td>
<td>0700</td>
<td>1/2 scoop Lundi</td>
<td>200g grated cheese</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p.m</td>
<td>1700</td>
<td></td>
<td>200g grated cheese</td>
<td></td>
<td></td>
</tr>
<tr>
<td>05-Sep</td>
<td>a.m</td>
<td>0700</td>
<td></td>
<td>1 pot cottage cheese</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p.m</td>
<td>1800</td>
<td></td>
<td>1 pot cottage cheese</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06-Sep</td>
<td>a.m</td>
<td>0730</td>
<td>1 scoop Lundi/6</td>
<td>200g grated cheese</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p.m</td>
<td>1630</td>
<td>1/2 scoop Lundi</td>
<td>300g cottage cheese/6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-Sep</td>
<td>a.m</td>
<td>0800</td>
<td>little lundi</td>
<td>300g cottage cheese/6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>some cheddar</td>
<td>mostly dandelion/6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
C3: Optimise condition of current release area

Introduction
The existing release area for the great bustard reintroduction project covers seven hectares. This area is enclosed by a 2m high predator-proof fence, with two electrified wires around the base, set at approximately 8cm and 20cm from the ground, and one approximately 25cm from the top. Figure 1 below shows the location of the release area, marked with a red line, and its immediate surroundings. The main habitat around the release area is grassland. A track runs close to the southern edge of the site, and after a narrow strip of grass, a block of arable land extends south. The enclosure runs along the north side of a valley which runs east to west. The southern edge of the enclosure finishes in the bottom of the valley and its northern edge is approximately half way to the top of the valley. The landscape in the wider area is comprised of rolling chalk hills with flat, open tops, divided by shallow valleys.

Land has been managed at this site for great bustards since the first release in 2004. In 2007 the original four hectare fenced area was extended to its current size. Habitat management within the enclosure is designed to provide the best possible conditions for
feeding, resting and breeding bustards, with the primary focus being on the period immediately after the release of new birds.

The habitat within the release area is a mosaic of grassland, lucerne, arable crops and periodically cultivated land. In order to keep this habitat in the best possible condition, a range of management activities are necessary. These are detailed below.

In addition, it is important to maintain the fence around the enclosure, to ensure mammalian predators are excluded from the site. This allows released birds to adapt to their new environment without immediately facing the threat of predation.

The release site should not be understood simply as the seven hectare fenced enclosure. In fact, the surrounding area and its suitability for bustards is equally important, and our input into the management of this area, including the management of predators, will also be considered.

**Release area habitat management**

Figure 2 shows the approximate layout of the release area. The numbers allow us to refer easily to individual parcels. These numbers will be used in the account of the management of the release area that follows.

![Figure 2: Layout of Release Site 1](image)

At the beginning of Year 1, the release site had been prepared for the release of 22 great bustards in September. In area 11, Albion fodder rape and Redstart rape-kale hybrid had been sown in two separate blocks, and in area 14, Swift rape-kale hybrid had been sown. These did not grow well, for a number of reasons. They were sown a little too late to be well established by the time the bustards started eating them. The ground was not weed
free, and it was lacking key nutrients. A leaf tissue analysis carried out in November on area 14 showed that most nutrients were at normal levels, but magnesium, boron and molybdenum were all present at very low levels. This issue was addressed by spreading manure across the whole site (excluding the fallow areas) in January.

As a result of this poor growth, the rape and rape-kale hybrid had been grazed off completely by bustards by the end of the year. In late January, there was nothing left of value to the birds, and both areas were ploughed.

The focus of summer management was to establish areas of oil seed rape which would be resilient to grazing pressure from released bustards and therefore provide a food source throughout the following winter. Until early February, area 3 was grass, but this was ploughed then kept free of weeds, along with area 13, throughout the summer. On 20th July, both areas were sown with a mix of 2/3 Lioness winter oil seed rape and 1/3 Albion fodder rape. This sowing date is around a month earlier than commercial oil seed rape crops are sown, and the crop established very well in both plots, reaching the end of August in good shape to provide for a new release of bustards in mid-September.

The opportunity was taken to plant another block of oil seed rape in area 14, on 10th August. A combination of the later planting date and competition from volunteer spring barley meant the rape plants were not nearly as advanced here as in plots 3 and 13 by the end of the month. Area 11 was ploughed twice to reduce the problem of volunteer barley, and made ready for winter wheat to be sown in early September.
A 3m strip of Wizard winter beans was ploughed in at the top of area 11 in November and grew well, providing a strip of patchy cover between the spring barley and the grass. Other small arable areas were 16, where spring barley was broadcast and rotavated in during March, and along the bottom fence of the pen, where sunflowers were planted in early May. These were intended to provide a visual screen between the track and the pen, but did not grow at all in areas 4 and 7. In area 15 they grew very well, but did not reach sufficient height to be an effective screen.

The blocks of lucerne in the pen (primarily areas 2, 6 and 12) were topped in November, then grew strongly in the spring. A late frost in early May killed most of the fresh growth, and from that point a rotational topping regime was implemented, to provide lucerne at various stages of growth throughout the summer. The plots were also topped in broad strips, to provide both cover and access for bustards. The areas of grass were topped in early February to break up the manure which had been spread, then allowed to grow until July. At this point, to control ragwort and to provide a habitat mosaic, they were partially topped, with areas of long grass left.

The fallow in areas 5 and 8 was ploughed in November then rotavated in early March to create bare ground for lekking bustards. Weed growth was controlled by rotavating in May then topping in August.
Although not in the release pen itself, it is worth noting that a plot of winter oil seed rape was established around the quarantine unit on 24\textsuperscript{th} June. This was grown to feed young birds in quarantine prior to their release, to introduce them to the main component of their diet after release. The sowing date was around a month earlier even than the rape in the pen, as it was needed by early August. It grew well, and provided food throughout the quarantine period.

Table 1 shows the habitat available to bustards in each area, and how it changed during the year. Table 2 details all habitat management activities carried out at the release site.

Table 1: Release site habitat through the year

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grass</td>
<td>Grass</td>
<td>Grass</td>
<td>Grass</td>
</tr>
<tr>
<td>2</td>
<td>Lucerne</td>
<td>Lucerne</td>
<td>Lucerne</td>
<td>Lucerne</td>
</tr>
<tr>
<td>3</td>
<td>Grass</td>
<td>Grass \rightarrow bare earth</td>
<td>Bare earth</td>
<td>Bare earth \rightarrow oil seed rape</td>
</tr>
<tr>
<td>4</td>
<td>Grass</td>
<td>Grass</td>
<td>Grass</td>
<td>Grass</td>
</tr>
<tr>
<td>5</td>
<td>Fallow</td>
<td>Fallow</td>
<td>Fallow</td>
<td>Fallow</td>
</tr>
<tr>
<td>6</td>
<td>Lucerne</td>
<td>Lucerne</td>
<td>Lucerne</td>
<td>Lucerne</td>
</tr>
<tr>
<td>7</td>
<td>Grass/lucerne</td>
<td>Grass/lucerne</td>
<td>Grass/lucerne</td>
<td>Grass/lucerne</td>
</tr>
<tr>
<td>8</td>
<td>Fallow</td>
<td>Fallow</td>
<td>Fallow</td>
<td>Fallow</td>
</tr>
<tr>
<td>9</td>
<td>Grass</td>
<td>Grass</td>
<td>Grass</td>
<td>Grass</td>
</tr>
<tr>
<td>10</td>
<td>Grass</td>
<td>Grass</td>
<td>Grass</td>
<td>Grass</td>
</tr>
<tr>
<td>11</td>
<td>Fodder rape/rape-kale hybrid</td>
<td>Fodder rape/rape-kale hybrid \rightarrow bare earth</td>
<td>Winter beans/spring barley</td>
<td>Winter beans/spring barley \rightarrow bare earth</td>
</tr>
<tr>
<td>12</td>
<td>Lucerne</td>
<td>Lucerne</td>
<td>Lucerne</td>
<td>Lucerne</td>
</tr>
<tr>
<td>13</td>
<td>Bare earth</td>
<td>Bare earth</td>
<td>Bare earth</td>
<td>Bare earth \rightarrow oil seed rape</td>
</tr>
<tr>
<td>14</td>
<td>Rape-kale hybrid</td>
<td>Rape-kale hybrid \rightarrow bare earth</td>
<td>Spring barley</td>
<td>Spring barley \rightarrow oil seed rape</td>
</tr>
<tr>
<td>15</td>
<td>Grass/clover</td>
<td>Grass/clover</td>
<td>Grass/clover</td>
<td>Grass/clover</td>
</tr>
<tr>
<td>16</td>
<td>Grass</td>
<td>Bare earth</td>
<td>Spring barley</td>
<td>Spring barley</td>
</tr>
</tbody>
</table>

61
### Table 2: Habitat management at the release site

<table>
<thead>
<tr>
<th>Date</th>
<th>Area(s)</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/11/2010</td>
<td>2, 3, 6, 11, 12, 16</td>
<td>Topped</td>
</tr>
<tr>
<td>12/11/2010</td>
<td>4, 7, 8, 15</td>
<td>Ploughed (just narrow strip along fence in 4, 7 and 15)</td>
</tr>
<tr>
<td>16/11/2010</td>
<td>11</td>
<td>Ploughed in 3m strip of winter beans (“Wizard”)</td>
</tr>
<tr>
<td>18/11/2010</td>
<td>5, 16</td>
<td>Ploughed</td>
</tr>
<tr>
<td>25/01/2011</td>
<td>All, except 5 and 8</td>
<td>Manure spread</td>
</tr>
<tr>
<td>31/01/2011</td>
<td>11, 14, 15</td>
<td>Ploughed (just narrow strip along fence in 15)</td>
</tr>
<tr>
<td>08/02/2011</td>
<td>1, 2, 9</td>
<td>Topped</td>
</tr>
<tr>
<td>08/02/2011</td>
<td>3, 4, 7</td>
<td>Ploughed (just narrow strip along fence in 4 and 7)</td>
</tr>
<tr>
<td>14/02/2011</td>
<td>13</td>
<td>Ploughed</td>
</tr>
<tr>
<td>17/02/2011</td>
<td>11, 14, 16</td>
<td>Rotavated</td>
</tr>
<tr>
<td>04/03/2011</td>
<td>5, 8</td>
<td>Rotavated</td>
</tr>
<tr>
<td>09/03/2011</td>
<td>11, 14</td>
<td>Spring barley drilled</td>
</tr>
<tr>
<td>14/03/2011</td>
<td>16</td>
<td>Spring barley broadcast and rotavated in</td>
</tr>
<tr>
<td>14/03/2011</td>
<td>3</td>
<td>Rotavated</td>
</tr>
<tr>
<td>14/03/2011</td>
<td>11, 14, 16</td>
<td>Cambridge ring rolled</td>
</tr>
<tr>
<td>19/04/2011</td>
<td>3, 4, 7, 13, 15</td>
<td>Rotavated (just narrow strip along fence in 4, 7 and 15)</td>
</tr>
<tr>
<td>03/05/2011</td>
<td>4, 7, 15</td>
<td>Sunflowers planted (narrow strip along fence)</td>
</tr>
<tr>
<td>03/05/2011</td>
<td>3, 5, 13</td>
<td>Rotavated</td>
</tr>
<tr>
<td>09/05/2011</td>
<td>2, 6</td>
<td>Topped</td>
</tr>
<tr>
<td>23/05/2011</td>
<td>3, 8, 13</td>
<td>Rotavated</td>
</tr>
<tr>
<td>10/06/2011</td>
<td>12</td>
<td>Topped</td>
</tr>
<tr>
<td>24/06/2011</td>
<td>3, 13</td>
<td>Rotavated</td>
</tr>
<tr>
<td>24/06/2011</td>
<td>Around quarantine</td>
<td>Rotavated, winter oil seed rape sprinkled, harrowed and rolled</td>
</tr>
<tr>
<td>20/07/2011</td>
<td>3, 13</td>
<td>Winter oil seed rape (“Lioness”, 2/3) and fodder rape (“Albion”, 1/3) sown</td>
</tr>
<tr>
<td>21/07/2011</td>
<td>6, 9, 11, 14</td>
<td>Topped</td>
</tr>
<tr>
<td>08/08/2011</td>
<td>11, 12</td>
<td>Topped</td>
</tr>
<tr>
<td>10/08/2011</td>
<td>14</td>
<td>Topped, ploughed, rolled, winter oil seed rape broadcast, harrowed and rolled</td>
</tr>
<tr>
<td>12/08/2011</td>
<td>2, 7, 8</td>
<td>Topped</td>
</tr>
<tr>
<td>17/08/2011</td>
<td>11</td>
<td>Ploughed</td>
</tr>
</tbody>
</table>
Fence maintenance and predator management

No substantial maintenance to the fence around the enclosure took place, and it remained predator proof throughout the period. Regular strimming was required throughout the summer to remove growth of vegetation from the electrified wires and prevent them being earthed. A large population of rabbits lives within the enclosure, and these tend to dig under the fence. A regular duty carried out during the year was to fill or block these small holes. Some control of rabbits was carried out during the winter, to reduce this problem.

Predator management in the area surrounding the release site was carried out by the farmer’s son on a casual basis. A substantial number of foxes were shot, but the overall population remained high, and there was an impact on survival of released birds. The Great Bustard Group has appointed a specialised member of staff who will be responsible for predator control around the release site from October 2011. This should improve our knowledge of the fox population around the site, and reduce the impact of fox predation on released birds. This report will deal much more comprehensively with predation in Year 2.

The wider release area

The farm around the release area underwent a transition between agri-environment schemes, moving from Countryside Stewardship (CSS) to new Entry Level Stewardship (ELS) and Higher Level Stewardship (HLS) agreements on 1\textsuperscript{st} April. Project staff provided advice while the new agreements were being developed, and on the location of new HLS options once the agreements were in place. Unfortunately a key element of the provisional agreement, 15 hectares of HF13 (fallow plots for ground nesting birds), was subject to the effects of government cuts and reduced to 5 hectares, a smaller area than in the previous CSS agreement.

This equates to three stone-curlew plots, all of which are located in areas which could be used by bustards – an improvement, as only one of the CSS stone-curlew plots was suitable for bustards. There are also three stone-curlew plots in the area managed by the MoD. These are left as long as possible during the winter without management, to provide weedy fallow for bustards. Adjacent to one of the MoD stone-curlew plots is a
new 2ha block of HF12 (wild bird seed mixture), which will be sown with a mixture of kale, sunflowers and cereal, with great bustards as the target species.

**Constraints**

The release site has organic status, which imposes substantial constraints on our management. All weed control, important for growing crops such as oil seed rape successfully, must be carried out mechanically. This is difficult to achieve without disturbing bustards. Soil nutrient levels are also more difficult to maintain without inorganic fertilisers. In May, we started the process of returning the site to non-organic status. The first step was for a parcel comprising the release site and a grass field to be separated into two parcels by the Rural Land Registry. We were still awaiting completion of this task at the end of August 2011, but expect progress to be made before 2012.

Habitat management at the release site was carried out using a 1950s Ferguson tractor. This was capable of doing most jobs, but not entirely reliable. Project staff were to some extent dependent on the farmer to assist with key tasks such as sowing crops, and at the same time constrained by the desire to avoid disturbing bustards in the pen. This combination could often mean that things did not happen at the right time. The sponsorship of a brand new tractor from New Holland in August (Figure 5) means that we will not be dependent on others in future. In Year 2, we will be able to carry out the required management at the correct time, and at a time that suits the birds.
An interesting feature within the release enclosure is a breeding pair of stone-curlew. The same pair has returned each year since 2006, making nine individual nesting attempts in the six year period and fledging six chicks. Management of the fallow areas within the pen for bustards is suitable for stone-curlews, but it is important that the location of stone-curlew eggs or chicks is known before any management is carried out within the enclosure. The presence of breeding stone-curlew also places limits on the acceptable level of disturbance caused by habitat management, even when bustards are not present.

Great bustard outcomes

Food was available in the pen for the young great bustards released in September 2010, and most birds did remain there for several weeks, feeding on the rape plots. However, the supply of rape did not last, due to the high grazing pressure from bustards and its poor establishment. This meant that by November, much more plentiful food was available in surrounding oil seed rape fields, and the young birds preferred not to spend time in the safety of the pen. The last sighting of a young bird in the pen was on 11th November.
Fox predation immediately around the release site was responsible for a high level of mortality of released birds in the first six weeks after release. Although it is not always possible to be certain of the cause of death, it is likely that at least eight of 21 released birds (38%) were predated in the first 40 days following their release, all but one within 1km of the release site. A further seven deaths (or incidents followed by permanent captivity) were likely to be due to collisions, with both fences and power lines. Five of these took place within 1km of the release site.

Snow and extreme cold weather in late December 2010 forced the wintering group of eight birds to disperse, with a strongly negative impact on their survival. It is possible that this could have been averted by ensuring availability of plant food by clearing snow from an oil seed rape field, or by providing supplementary food in the form of pellets. Once the supply of rape had been exhausted, there was very limited food available for bustards at the release site until the spring. As a result, no bustards were seen at the release site itself between mid-November and mid-March, at the beginning of the lekking season. A group of four bustards spent most of the second half of the winter on an oil seed rape field close to the site.

The use of decoys and the provision of suitable bare habitat ensured that most great bustard lekking activity took place within the pen. A maximum of two males were seen together at the lek, joined by a maximum of two females. The enclosure was used almost constantly by between one and two males from the end of the spring lek 2011 until the end of August, feeding and loafing in grass, lucerne and fallow.

**Actions for Year 2**

- Assess causes of mortality occurring within 1km of the release enclosure with a view to making site improvements.
- If snow covers all oil seed rape, clear an area, either at the release site or in a nearby field, to make it accessible to bustards, and provide supplementary food at the release site.
- Increase the area of arable crops and fallow in the pen, with a corresponding reduction in the area of grass and lucerne, as these are used less intensively by bustards.
- Retain the rotational topping regime for lucerne, and maintain a mosaic of short and long patches of grass.
- Plant sunflowers along the bottom edge of the pen again, choosing a taller-growing variety.
• Plant canary grass and sorghum in a strip between the pen and the track, as another screen between the two.
• Complete the process of returning the release site to non-organic status.
• Record the use of different areas of the enclosure by great bustards, in order to analyse their use of the site and inform further improvements to it.

**C5: Protect bustards and their nests from direct threats**

The main activities under this action in Year 1 were the protection measures implemented for two great bustard nests.
C6: Promote existing and develop new agri-environment options
Context

Between the LIFE+ application and its subsequent approval, there were significant changes within Natural England (NE), the Non-Departmental Public Body that administers the Environmental Stewardship scheme, and to the scheme itself. In June 2010, the newly elected UK government announced wide ranging cuts throughout the public sector. By October 2010 it had become clear that the Department for Environment, Food and Rural Affairs (Defra) would face budget cuts of 30% over four years. One of the consequences of this was a restructuring of NE, resulting in 800 staff losses, around one third of the total workforce.

At the same time, there was an immediate freeze in new Higher Level Stewardship (HLS) agreements. By April 2011, agreements were being processed once again, but at a lower rate and in a more tightly targeted manner. A backlog of applications had built up over the preceding months, making it impossible for all interested farmers to access the scheme. The amount of money available to individual agreements also fell sharply, reducing the area of options funded per agreement.

As a result of these changes, when the project adviser took up his post in March 2011, there was far less opportunity within Environmental Stewardship to provide habitat for great bustards than could have been envisaged when the LIFE+ application was submitted.

Development of habitat advice for great bustards

The highest priority for Year 1 was to develop detailed habitat advice for great bustards, based on all available information. Once brought together, this could be used as a basis for action D4 (Produce leaflet for local farmers and landowners). It was important to assess how the habitat requirements of great bustards fit into existing Environmental Stewardship options. The result of this work is the document in Appendix 1, and the leaflet for farmers and landowners is in Appendix 2.

Through this work, we established that a number of Entry Level Stewardship (ELS) and HLS options were potentially suitable for great bustards, either as currently prescribed or with slight modifications. These cover all stages of the lifecycle, and therefore it is quite possible that no new options will be required. However, it is important to note that at this time all options remain untested for great bustards.
Although great bustards have no specific requirements which differ from other commoner farmland birds, there are details of scale, location and combination of options which are great-bustard specific. For the reintroduction project to have a good chance of success, a substantial area of land around project release sites will need to be managed with great bustards in mind. This is not possible in present circumstances.

To assist with the process of developing habitat advice, the project team visited the Austrian great bustard LIFE+ project (“Cross-border protection of the great bustard in Austria – continuation”) in April 2011. The recovery of the great bustard population in Austria over the last fifteen years has been based largely on good habitat management through agri-environment schemes, and the opportunity to learn how the Austrian scheme works was extremely beneficial. We were able to see an established and successful set of agri-environment measures designed specifically for bustards, and this will be a key part of our thoughts about an ideal set of measures we would like to implement in this country.

**Working with Natural England to coordinate approach**

Despite the challenging funding environment, as a LIFE+ project partner, NE remained supportive of the project’s goals. Several meetings took place between project staff and NE staff, both locally and nationally. On 3rd February 2011, an initial meeting was used to outline the LIFE+ project to the Wiltshire NE team and discuss Action C6 with them. At a follow-up meeting on 4th May 2011, the Project Adviser was introduced to the same team, along with farmland bird project officers from around the region. We were also updated on the restructuring that had occurred within NE in March, which did not cause too many staff changes in the county.

Soon after this meeting, the Project Adviser met with NE and other farmland bird advisers to look at farms due to enter HLS, and ensure that there was a great bustard input when those farms were in the project’s target area.

On 14th July, the Project Manager met with national NE staff to discuss the best approach to providing habitat for great bustards within Environmental Stewardship. It was made clear that as a consequence of the very low number of great bustards in Wiltshire, and
the high demand for HLS money which is currently in limited supply, it would not be possible to direct HLS resources specifically at great bustards. The project was encouraged to work with ELS, and to use HLS options targeted at more widespread farmland birds. As the population of great bustards increases, this will be reconsidered.

The meeting also established a “Great Bustard Champion” within the Wiltshire NE team, to work with the Project Adviser and ensure key great bustard areas contain the correct range of options. It was agreed that NE would supply maps showing which farms within the project area have agreements with options beneficial to great bustards, to help identify gaps in provision. These are included in Appendix 3.

Future work with Natural England will include the establishment of a Great Bustard Habitat Working Group, including both NE advisors and advisors from other local projects, to look at habitat provision for great bustards. This will meet for the first time in October 2011.

Habitat advice provided

The Project Adviser provided advice on two key farms in Year 1.

A new HLS agreement at Release Site 1 started on 1st April 2011, and as such it was too late for the Project Adviser to influence the content of the agreement. However, before the start of the LIFE+ project, the Great Bustard Group had been in discussions with the owner of the farm, and some provision for great bustards had been included. As originally agreed, the scheme would have provided 15ha of HF13 (fallow plots for ground nesting birds) and 6ha of HF12 (wild bird seed mixture). This agreement was being processed at the time when government cuts hit hard, and the area of HF13 was reduced to 5ha by the time the agreement became live in April. This was disappointing, as this is the only option known to be attractive to great bustards.

We were able to advise on the location of plots of these options. The HF13 was split into three plots of around 1.7ha each. The farm had three stone-curlew plots in its Countryside Stewardship agreement, but none were in good locations for great bustards. All three were moved, and should now be more likely to be used by bustards.
Of the HF12, 4ha was spring sown cereal for corn buntings in the winter, and therefore not particularly suitable for great bustards. The remaining 2ha was a plot specifically for great bustards, with a seed mix (33% kale, 40% sunflower, 27% cereal) designed by the Great Bustard Group and the RSPB regional farmland bird adviser. This was located adjacent to an MoD stone-curlew plot in the area of the farm most favoured by bustards.

The second farm advised on shares its northern boundary with the farm chosen as Release Site 2 for 2011. Its owner was considering an HLS application in 2011, and as a result we took the opportunity to advise on the content of the agreement. We recommended plots of HF12, HF13 and EF4 (nectar flower mixture) in the fields closest to the designated bustard release area. The owner was enthusiastic about implementing a wide range of options for a variety of farmland birds, but NE budget limitations meant the scheme could not meet his expectations, and he did not submit the application.

**Actions for year 2**

- Distribute leaflets to farmers and landowners around the project area.
- Provide visits to farmers inquiring about the project/leaflet.
- Run demonstration day for farmers at the project site.
- Target key landowners at and around project release sites, where opportunity exists to create new agreements or amend existing ones.
- The most important expiring Countryside Stewardship agreement in 2012 is at Release Site 2, where bustards were released in 2011. A new HLS agreement here has the potential to trial the suitability of several HLS options for great bustards. The content of this agreement should be a high priority for the project adviser.

**Appendices**

Appendix 1: Managing farmland for great bustard
Appendix 2: Action D4 – Leaflet for local farmers and landowners
Appendix 3: Maps showing stewardship agreements within the project area with any of the following options (or their Countryside Stewardship equivalents) – EF2, EF13, EF22, HF12, HF13, HF14, HF20
Great bustard history
Great bustards were formerly widespread in the UK with records of birds from most English counties. The former strongholds were found in Wessex, East Anglia and the Yorkshire Wolds. During the 18th and 19th centuries, great bustards suffered a dramatic decline in numbers across their range due to changes in agricultural practices and persecution from humans and by the mid 19th century they had become extinct.

UK re-introduction
The UK is obliged under EU legislation (Habitats Directive 1992) to reintroduce species where it is considered feasible. The Great Bustard Group (GBG) was set up in 1998 to explore the possibility of reintroducing the great bustard to the UK. In 2003, following a GBG feasibility study, Defra issued a 10-year trial-licence. So far, over 100 bustards have been released in the Wiltshire countryside. They are a long-lived bird, not breeding until they are typically five years old, and as anticipated the first successful breeding occurred in 2009, the first in the UK for 177 years.

The gently rolling landscape of Wessex with its arable fields and grasslands is ideal habitat for great bustards. Salisbury Plain, the largest open expanse of chalk grassland in Western Europe, provides suitable cover, animal and plant food and the surrounding arable fields bear crops that are important food plants. This land can also be managed under Environmental Stewardship, providing habitats suitable for bustards and a wide range of UK BAP and red listed farmland species.

Great bustard requirements
This species depends on large areas of extensively managed, open and undisturbed farmland. Bustards will avoid trees, hedgerows, fences, power lines, roads, tracks and footpaths. Location is critical – habitat intended for bustards but wrongly situated will not be used. In the winter, the main requirement is an area of plant and seed rich habitat, with a preference for oil seed rape. During the breeding season, bustards need areas of invertebrate rich habitat close to safe nesting sites. This can be achieved through a mosaic of fallow, wild bird seed mixture, nectar flower mixture and grass. Any Environmental Stewardship agreement should provide all of these required habitat elements.
1. Safe nesting and summer feeding habitat

To be effective, the following options need to be provided in combination with one another, in the middle of large fields, towards the top of hills, with an uninterrupted view in at least three directions. Female great bustards are very faithful to their nest site, so the same area needs to be suitable for nesting each year.

- **Nectar flower mixture**
  These plots can provide a secure nesting site and a valuable source of insect rich habitat for foraging great bustards and their chicks. They need to be sited as blocks in open landscapes or alongside linear features such as beetle banks. They should not be placed alongside tracks or hedgerows. The guidelines ask for half of the area to be cut in June, but it is essential to check for nesting birds before cutting such habitats at this time of year. To be particularly beneficial to great bustards, lucerne should make up the largest component of the seed mix up to a maximum of 50% by weight, as this is a favoured food plant.

<table>
<thead>
<tr>
<th>Entry Level Stewardship (ELS)</th>
<th>Organic Entry Level Stewardship (OELS)</th>
<th>Higher Level Stewardship (HLS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nectar flower mixture (EF4) 450 pts/ha</td>
<td>Nectar flower mixture (OF4) 550 pts/ha</td>
<td></td>
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</table>

- **Conservation headlands**
  Autumn sown cereal crops can provide the right conditions for great bustards to nest. However, nests in cereals are vulnerable to in-field management, as incubating female bustards are particularly prone to disturbance. Used in an open landscape along buffer strips or beetle banks and away from hedgerows and fences, conservation headlands with a minimum width of 16m can be of benefit to great bustards. A strip around the edge of a cereal crop is left with no pesticide or herbicide applications, enabling beneficial insects to enter the crop and ensuring that any nesting birds will not be disturbed. The HLS option will benefit a wide range of species, both before and after the harvest.

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<tr>
<th>Entry Level Stewardship (ELS)</th>
<th>Organic Entry Level Stewardship (OELS)</th>
<th>Higher Level Stewardship (HLS)</th>
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</thead>
<tbody>
<tr>
<td>Unfertilised cereal headlands (EF9) 100 pts/ha</td>
<td>N/A</td>
<td>Unharvested fertiliser-free conservation headland (HF14) £440/ha</td>
</tr>
<tr>
<td>Unharvested cereal headlands (EF10) 330 pts/ha</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
Wild bird seed mixture plots

Autumn sown plots of wild bird seed mixture can also provide an alternative safe nesting site and foraging area, but are only available under HLS. The ideal minimum size would be 2ha, with the preferred mix predominantly composed of cereals. A range of farmland birds will benefit from the seed available in the second winter, and the plot could also provide a nesting site for corn buntings. Spring sown ELS plots will provide suitable feeding sites for bustards during the breeding season.

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<tr>
<th>Entry Level Stewardship (ELS)</th>
<th>Organic Entry Level Stewardship (OELS)</th>
<th>Higher Level Stewardship (HLS)</th>
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<tbody>
<tr>
<td>Wild bird seed mixture (EF2) 450pts/ha</td>
<td>Wild bird seed mixture (OF2) 550pts/ha</td>
<td>Enhanced wild bird seed mix plots (HF12 £475/ha)</td>
</tr>
</tbody>
</table>

Fallow plots

Unmanaged fallow plots are another potential safe nesting site and provide an important foraging area. The same management will benefit both great bustards and stone-curlews. If the plots are managed in halves and left over the winter, the resulting weedy fallow on half the plot in spring could benefit bustards. This would also benefit other farmland birds over the winter. If managed correctly, fallow plots can also benefit a range of rare arable plants. The ELS option of extended overwintered stubble will through natural regeneration provide winter food and safe summer nesting and feeding habitat for bustards.

<table>
<thead>
<tr>
<th>Entry Level Stewardship (ELS)</th>
<th>Organic Entry Level Stewardship (OELS)</th>
<th>Higher Level Stewardship (HLS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncropped, cultivated areas for ground-nesting birds on arable land (EF13) 360pts/ha</td>
<td>Uncropped, cultivated areas for ground-nesting birds on arable land (OF13) 360pts/ha</td>
<td>Uncropped, cultivated areas for ground nesting birds on arable land (HF13) £360/ha</td>
</tr>
<tr>
<td>Extended overwintered stubble (EF22) 410pts/ha</td>
<td>N/A</td>
<td>Cultivated fallow plots or margins for arable plants (HF20) £440/ha</td>
</tr>
</tbody>
</table>

Buffer strips and beetle banks in arable land

Grass margins and beetle banks, managed without pesticides and fertilisers and cut less than annually, can provide secure nest sites for great bustard if placed alongside wild bird seed mixture or nectar flower mixture. They can also supply a rich source of insects for newly hatched chicks, but will only be used by great bustards in open landscapes, not along hedgerows, tracks or fences. Where rare arable plants are known to be present, use cultivated fallow margins instead, as these will also provide suitable seeds and insects.
### Unimproved/semi-improved grassland

‘Rougher’, less improved grasslands will support good populations of invertebrates. Low intensity management (e.g. lower stocking levels and little or no fertiliser inputs) will produce suitable conditions for these invertebrates to thrive. Bustards may feed or nest in such grasslands. Although species-rich, semi-natural grasslands are targeted by HLS for their botanical value, such grasslands typically host many invertebrates, which are valuable as chick food.

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<thead>
<tr>
<th>Entry Level Stewardship (ELS)</th>
<th>Organic Entry Level Stewardship (OELS)</th>
<th>Higher Level Stewardship (HLS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2m buffer strips on cultivated land (EE1) 300pts/ha</td>
<td>2m buffer strips on cultivated land (OE1) 400 pts/ha</td>
<td>Floristically enhanced grass buffer strips (HE10) £485/ha</td>
</tr>
<tr>
<td>4/6m buffer strips on cultivated land (EE2/3) 400pts/ha</td>
<td>4/6m buffer strips on cultivated land (OE2/3) 500pts/ha</td>
<td></td>
</tr>
<tr>
<td>Management of field corners (EF1) 400 pts/ha</td>
<td>Management of field corners (OF1) 500 pts/ha</td>
<td></td>
</tr>
<tr>
<td>Beetle banks (EF7) 580pts/ha</td>
<td>Beetle banks (OF7) 750pts/ha</td>
<td></td>
</tr>
<tr>
<td>Uncropped cultivated margins for rare plants (EF11) 400 pts/ha</td>
<td>Uncropped cultivated margins for rare plants (OF11) 460 pts/ha</td>
<td></td>
</tr>
</tbody>
</table>

### 2. Summer lekking habitat

Great bustards use traditional lek sites, which may be on bare ground or short grass. The condition of these sites must be maintained.

- **Unimproved/semi-improved grassland**

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<tr>
<th>Entry Level Stewardship (ELS)</th>
<th>Organic Entry Level Stewardship (OELS)</th>
<th>Higher Level Stewardship (HLS)</th>
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</thead>
<tbody>
<tr>
<td>Permanent grassland with low inputs (EK2) 85pts/ha</td>
<td>Permanent grassland with low inputs (OK2) 115pts/ha</td>
<td>Maintenance, restoration or creation of species-rich, semi-natural grassland (HK6/7/8) £200/200/280/ha</td>
</tr>
<tr>
<td>Permanent grassland with very low inputs (EK3) 150pts/ha</td>
<td>Permanent grassland with very low inputs (OK3) 180pts/ha</td>
<td>Maintenance, restoration or creation of grassland for target species (HK15/16/17) £130/130/210/ha</td>
</tr>
</tbody>
</table>
Tightly grazed grassland maintained for summer feeding of stone-curlew would also suit great bustards.

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<tr>
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<th>Organic Entry Level Stewardship (OELS)</th>
<th>Higher Level Stewardship (HLS)</th>
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</thead>
<tbody>
<tr>
<td>Maintenance of grassland for target species (HK15) £130/130/210/ha</td>
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- **Fallow plots**
  Fallow plots, with bare ground created by the end of February, provide ideal conditions for lekking bustards.

3. Winter feeding habitat

- **Wild bird seed mixture plots**
  Through the winter, great bustards require an area of plant and seed rich habitat within an open landscape. This can be provided using wild bird seed mixture plots, which would ideally be placed alongside an area of nectar flower mixture or a fallow plot. These will also benefit a range of farmland birds by providing a source of food over the winter. To benefit great bustards, the HLS option (HF12) is preferred, with a suggested low density kale based mix, providing a two-year food source. This mix will also benefit grey partridge.

- **Overwintered stubbles**
  Stubbles left over winter, particularly those with broad-leaved weeds, can be a very important source of food for many farmland birds, including great bustards. Bustards will feed on spilt grain and weed seeds and leaves found in these fields. There are several stubble options in Environmental Stewardship. The brassica fodder crop option would be particularly beneficial, as brassicas are an important food plant of great bustards.

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<tr>
<th>Entry Level Stewardship (ELS)</th>
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<th>Higher Level Stewardship (HLS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overwintered stubble (EF6) 120pts/ha</td>
<td>Overwintered stubble (OF6) 150pts/ha</td>
<td>Brassica fodder crops followed by overwintered stubble (HG5) £90/ha</td>
</tr>
<tr>
<td>Reduced herbicide cereal crops followed by overwintered stubble (EF15) 195pts/ha</td>
<td>N/A</td>
<td>Fodder crop management to retain or recreate an arable mosaic (HG6) £150/ha</td>
</tr>
</tbody>
</table>
Extended overwintered stubble (EF22) 410pts/ha | N/A | Low input spring cereal to retain or recreate an arable mosaic (HG7) £250/ha

Cereals for whole crop silage followed by overwintered stubble (EG4) 230pts/ha | Cereals for whole crop silage followed by overwintered stubble (OG4) 250pts/ha

**Undersown spring cereals**
Great bustards will benefit from a mixed farming system, as it should automatically provide the mosaic of habitats they require. Undersown spring cereals, an option designed to encourage mixed farming, should be particularly beneficial for bustards as legumes are an important food plant. The undersown grass ley is required to contain between 10 and 30 per cent legume by weight.

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<tr>
<th>Entry Level Stewardship (ELS)</th>
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<th>Higher Level Stewardship (HLS)</th>
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<tbody>
<tr>
<td>Undersown spring cereals (EG1) 200pts/ha</td>
<td>Undersown spring cereals (OG1) 150pts/ha</td>
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</table>

**Fallow plots**
Fallow plots left unmanaged through the winter can be a source of winter food for bustards, offering a variety of broad leaved weeds.

For further information on managing land for great bustards using Environmental Stewardship, please contact:

Andrew Taylor  
Great Bustard LIFE+ Project Adviser  
andrew.taylor@rspb.org.uk  
c/o RSPB  
The Lodge  
Sandy  
Bedfordshire  
SG19 2DL  

Telephone: 07703 607586  
E-mail:
Great bustards became extinct in the UK in 1832 after years of hunting, persecution and habitat destruction, but now they’re on their way back.

A trial reintroduction project run by the Great Bustard Group began on Wiltshire’s Salisbury Plain in 2004, and there have so far been many encouraging signs.

In 2009 the first great bustard chicks for 177 years hatched in the UK, followed by further healthy chicks in the following years. We hope that a small population is starting to become established, and we're counting on your help to keep their numbers growing.

An EU-funded LIFE+ project will run until 2015, bringing the Great Bustard Group into partnership with the RSPB, University of Bath and Natural England, and enabling a wide range of new work.

The world’s heaviest flying bird
- The great bustard is a globally threatened species.
- They can weigh an incredible 20 kg.
- Fully-grown adult males have a wing span of around 2.5 metres.
- They grow to over 1 metre tall.
- Males are much larger than females.
- If you see a great bustard, please report it to the project. It is very important that we’re able to follow the movements of birds. Released birds carry wing tags, colour coded by year.

Bustard habitat
Great bustards depend on large areas of extensively managed, open and undisturbed farmland, avoiding hedgerows, trees, power lines, tracks and areas of frequent human activity.

They nest in grass, fallow or cereal crops – wherever they can find cover and an uninterrupted view in at least three directions. Females are very faithful to their nest site. Neats and chicks can be vulnerable to farming operations and predation by foxes.

Seasonal habits
March to April – Males gather at traditional lekking sites and display to females.
May to July – Once mated, females nest in grass, fallow or cereal crops. Chicks leave the nest immediately, and feed mainly on insects and start flying at seven weeks old.
August to September – After breeding, diet comprises insects, seeds and broad-leaved plants.
October to February – Birds flock together in the winter, feeding in oilseed rape and areas of plant and seed-rich habitat.

How can you help?
The guidelines below should help you create the ideal conditions for bustards on your farm. Please contact the project for more free advice.

Nesting habitat
- Great bustards can nest in grass or reed flower mixture plots when they offer sufficient cover for the female during the spring.
- Fallow plots with dense natural regrowth in March and April can be suitable for nesting.
- Autumn-sown wild bird seed mixes or conservation headlands provide crops favourable for nesting.
- Breeding females are vulnerable to disturbance, especially during May. The project can provide assistance if you discover one on your farm.
- Control of predators, especially foxes, around any nest site will increase the likelihood of success.

Summer food
- A mosaic of habitats that bustards can move between on foot enables them to find insect food close to their nest site.
- Wild bird seed mixes, low input cereal crops and conservation headlands boost broad-leaved weeds and associated insects.
- Fallow plots with a combination of bare ground and broad-leaved weeds are ideal for bustards.
- Nectar flower mixture plots provide food for insects. Lunaria, which is a favoured plant food for bustards, is a useful component.
- Unimproved or semi-improved grasslands wide, rough grass buffer strips and hedge banks increase insect populations.
D2: Erect project noticeboards

For this action two information boards about the project were produced and erected. One, at the Hawk Conservancy Trust, Andover, next to the Great Bustard aviary to provide information to the visitors there; this is also a great opportunity to use the information board to promote and advertise visits to the Great Bustard project site, as The Hawk Conservancy Trust welcomes 60,000+ visitors per year. The other was put up at the project site, on the outside of the viewing shelter next to the shop/information centre to provide information to visitors. This will also be useful when we have large numbers of visitors to the project site, as we will be using the viewing shelter more often, as well as our main hide.

At the Hawk Conservancy Trust

At the Great Bustard project site, outside viewing shelter.
D4: Produce leaflet for local farmers and landowners

The design of a leaflet for local farmers and landowners was completed in August 2011. It was produced in a print run of 1000 copies, as specified in the action. The leaflet was disseminated through two main routes: to NFU members around Salisbury and Marlborough and to farmers on an RSPB stone-curlew project contact list covering the whole of the great bustard project area. This approach is likely to have caused some farmers to receive more than one leaflet, but should have achieved good coverage across the whole project area and beyond.

Several hundred leaflets were retained for use at project events and distribution to farmers by monitoring staff. It was important to retain a large number of leaflets, as it is not expected that the leaflet will be reprinted with revised information until towards the end of the project.

The leaflet is shown in Appendix 2 of section C6.
D5: Produce promotional flyer for the general public

The promotional flyer for the general public was printed in July, with an initial print run of 2500 copies. The action specifies that it should be produced in an annual print run of 50,000, but it was unclear how such a large quantity of leaflets could be distributed. Given the difficulty in storing leaflets in bulk, and the low printing cost, it was decided to print a smaller number and order more when required. We used RSPB regional office staff to help support the distribution of around 2000 leaflets, which went to the following sites:

- RSPB Arne
- RSPB Radipole Lake
- RSPB Darts Farm
- RSPB Midlands Region
- RSPB South East Region
- RSPB South West Local Groups
- Wiltshire TICs (Trowbridge, Melksham, Avebury, Marlborough, Swindon, Bradford-on-Avon, Chippenham, Corsham, Malmesbury – note that GBG leaflets are already distributed to Salisbury, Amesbury, Warminster and Devizes)
- Dorset TICs (Shaftesbury, Sherborne, Blandford Forum, Dorchester, Bridport, Lyme Regis)
- Somerset TICs (Frome, Shepton Mallet, Yeovil, Taunton, Wellington, Bath, Bristol)
- Hampshire TICs (Andover, Winchester)
- Main TICs in Devon and Cornwall
D7: Carry out programme of media work

Great Bustard LIFE+ Project – Press release No.1 – Wed 19th Jan 2011

Radio 4  News bulletins from 6am – lunchtime.

Meridian TV – 6pm

Podcasts with Al Dawes and Tracé Williams – GBG website


http://www.guardian.co.uk/commentisfree/2011/jan/20/in-praise-of-great-bustard-group

BBC [6pm news]

Radio Wales [6.30pm]

Radio 2 - breakfast

Piece in Western Daily Press

BBC Wiltshire: http://www.bbc.co.uk/news/uk-england-wiltshire-12218959

BBC Science and Env. homepage:
http://www.bbc.co.uk/news/science_and_environment/


Independent: http://www.independent.co.uk/environment/nature/eu-grant-to-bring-back-great-bustard-2187883.html

BBC Breakfast: ‘Funding boost for Great Bustards’ [6.56am]

BBC Points West: live lunchtime broadcast. [1:30pm]

BBC Points West: pre-recorded broadcast to be shown this evening. [6:30pm]

ITV West Country Tonight: pre-recorded broadcast to be shown this evening. [6.00pm]
media release

Press release issued on behalf of the following partnership:
Great Bustard Group, Natural England, RSPB; and the University of Bath

Embargo date: suggest Thursday 13 January, 2011

BREATHING NEW LIFE INTO SALISBURY PLAIN

An ambitious programme to return the world’s heaviest flying bird to the UK has been given a considerable lift from the European Union.

The Great Bustard Project, based on Salisbury Plain, has been awarded a EU LIFE+ €2.2million grant to enlarge the project over the next five years. The EU LIFE+ project is run by the RSPB, Great Bustard Group, University of Bath and Natural England.
LIFE+ Project “Reintroducing the Great Bustard Otis tarda to Southern England (LIFE09/NAT/UK/020): Year 1 Summary

The grant, which will provide 75 per cent of the project’s costs, will transform the Great Bustard Reintroduction Trial. The Great Bustard Group, which has led the project since its inception in 2004 has battled to cover the costs of the project with a hand-to-mouth existence.

Releasing great bustards reared from eggs rescued in southern Russia, the project had its greatest success in 2009, when the oldest males became sexually-mature and mated successfully, producing the first great bustard chicks to hatch in the wild in the UK for 177 years.

“Despite our great successes over the last six years we would sometimes struggle to find £10 or £20 to put diesel in the old Land Rover; now we have the chance to give this project real wings,” says David Waters GBG Director. He continued: “The funding will provide a properly-resourced project, with four new posts, new monitoring equipment and even the possibility of a second release site.”

David Waters added: “The Great Bustard Group is anxious to point out that the grant will not end the funding worries as a quarter of the project costs will need to be found by the project partners, and the LIFE project is very much about new work. Much of the existing work will need to be funded as before.”

Tracé Williams, previously the RSPB’s Chalk Grassland Restoration Manager based in Wiltshire, has been appointed as LIFE Project Manager for the RSPB. “It is so exciting to be working with these charismatic birds and with the staff who have achieved so much already in this awe-inspiring project. The funding will take the project to another level, with more security and a greater ability to gather vital information on the birds.”

An early impact of the project has been the way in which monitoring has been conducted on this year’s release of great bustards. Sixteen of them are carrying GPS satellite transmitters. Prof. Szekely from Bath University explains: “Monitoring is an essential element of the LIFE+ project. We need to understand what the released bird do, what food they eat, how they interact with other bustards and how they evade enemies. Effective monitoring will give us the information we need to improve the survival and reproduction of British bustards.”

The LIFE+ project brings the Great Bustard Project into mainstream conservation, with Natural England, the government agency for nature conservation in England, as a partner. Ian Carter of
Natural England welcomed the new partnership: ‘The LIFE funding will clearly put the project on a much firmer footing and ensure that key areas such as monitoring of the released birds are adequately resourced. We are set to learn a great deal more about this species over the coming five years!’

The great bustard is one of a number of species that the RSPB is working in partnership to restore to our countryside. RSPB species recovery officer, Leigh Lock said: “Great bustards last bred in the UK in 1832, and the RSPB is delighted to be working with partners to re-establish them as breeding birds after an absence of 170 years. We also hope that the great bustard project will help promote the restoration of a lost landscape in southern England that will support some of our other rare and threatened wildlife.”

ends

For further information and to arrange an interview, please contact:

Great Bustard Group: David Waters, Great Bustard Group,
RSPB: Grahame Madge, RSPB press officer, on 01767 681577.
Out of hours, please telephone: 07702 196902 (mobile)
Natural England: Beth Rose
University of Bath: Katrina James press@bath.ac.uk

Photographs:
Photographs are available to download free of charge from the RSPB Images website. To download images, click on the hyperlink below and please enter the username and password when prompted.

Hyperlink:
User Name:
Password:

Broadcast-quality radio interviews:
RSPB: To arrange an ISDN broadcast-quality radio interview with an RSPB spokesman please contact Grahame Madge at the RSPB press office.

Editor’s notes:

The Royal Society for the Protection of Birds
• The Lodge • Sandy • Beds SG19 2DL
Press office telephone 01767 681577
Website:www.rspb.org.uk

Registered charity no 207076
FOR IMMEDIATE RELEASE

All of a flutter on Salisbury Plain

Forget those catwalk extravagancies – Wiltshire’s great bustards are showing some real style on Salisbury Plain this Spring.

Dave Kjaer, photographer for the Great Bustard Project, caught these stunning images of one of the recently reintroduced males in full display.

Bath University researcher Kate Ashbrook, who is working with the project, said; “Seeing these birds showing off in all their finery is an unforgettable experience. This is the bird’s way of signaling that he’s in good condition, to both attract potential mates and repel rivals.”

The Great Bustard Project is successfully reintroducing great bustards to the UK. The project, assisted by EU Life+ funding, is run by a partnership of the RSPB, Great Bustard Group, University of Bath and Natural England.

David Waters from the Great Bustard Group said “Spring is the busiest time of year for us. I’ve recently been in Saratov, Russia working with Russian ornithologists to bring this year’s batch of young bustards to Wiltshire. Meanwhile colleagues in the UK are working hard monitoring the bustards previously released on Salisbury Plain.

“Those birds that are already out on the Plain will be on eggs soon, and we hope to see the first wild youngsters by the end of the month.”

The great bustard is a globally threatened species that is listed on Annex I of the EC Birds Directive and is also identified as a priority for LIFE+ funding.

It was formerly widely distributed across large parts of lowland Europe, but started to decline in the 18th century and is now absent from much of its original range. It became extinct from the UK in 1832, and from numerous other European nations over the rest of the 19th and the 20th centuries. It is responding well to conservation and many populations are now increasing.

Visitors are welcome to the great bustard release site to learn about the project and see the spectacular scenery and wildlife of Salisbury Plain. To book a visit phone 07817971327 or email visit@greatbustard.org
Additonal Notes

1. The Great Bustard Group is a UK Registered Charity (number 1092515) that aims to establish a self-sustaining population of Great Bustards in the UK and create practical conservation measures for Great Bustards in Saratov, Russia. The group was created in 1998 to restore the Great Bustard (Otis tarda) population in the UK and to conserve existing Great Bustards throughout their range, particularly in Saratovskya, Russia. On Salisbury Plain a small bustard population is being created by releasing a number of birds each year.

2. The RSPB is the largest wildlife conservation organisation in Europe with over one million members. It speaks out for birds and wildlife, tackling the problems that threaten our environment. Bird populations reflect the health of the planet on which our future depends. The RSPB became an official partner of the Great Bustard Consortium in August 2009.

3. Natural England is an independent public body whose purpose is to protect and improve England’s natural environment and encourage people to enjoy and get involved in their surroundings. Natural England have been involved in the Great Bustard Reintroduction project since its inception, particularly the licensing aspects and the monitoring of released birds.

4. The University of Bath is one of the UK’s leading universities. Our Mission is to deliver world class research and teaching, educating our graduates to become future leaders and innovators, and benefiting the wider population through our research, enterprise and influence. Our courses are innovative and interdisciplinary and we have an outstanding record of graduate employment. We are ranked in the UK top 15 of universities in The Guardian, Times, Sunday Times and Independent national tables. There will be one full time post at the university dedicated to the monitoring of the bustards.

5. LIFE is the EU’s financial instrument supporting environmental and nature conservation projects throughout the EU, as well as in some candidate, acceding and neighbouring countries. Since 1992, LIFE has co-financed some 3115 projects, contributing approximately €2 billion to the protection of the environment. In 2010 the Great Bustard Project was awarded a €2.2 million grant to enlarge the project over the next five years.
D8: Run project demonstration days

Year 1 report
01/09/2010 – 31/08/2011

Introduction

This action requires project staff to organise and run four demonstration days in each year of the project. These days should be aimed at key stakeholder groups such as farmers, landowners, government officials and conservation practitioners from the UK and elsewhere. They allow first-hand sharing of information and experience with selected key stakeholders, allowing staff to interact with groups who have the potential to influence great bustard conservation beyond the scope of the project.

Demonstration days held during Year 1

The LIFE+ project was fully staffed only for the second six months of this year. As a result, only three demonstration days were organised during Year 1. The table below gives a summary of the demonstration days that were held. More information on the content and value of each day follows. A priority in Year 1 was to gather information from a wide range of experienced individuals on key aspects of the project. This was the purpose of the Technical Working Groups.
Technical Working Group No. 1 was chaired by Paul Goriup, an independent bustard specialist. Attendees included all members of the LIFE+ Project Steering Group, representatives of the RSPB at local and regional level and from the national Conservation Science department, representatives of University of Bath and the MoD. Mikhail Oparin and Olga Oparina from the Saratov Institute of Ecology in Russia were present, as was Zsolt Végvári from the Hungarian Great Bustard Project, who gave a presentation.

Discussion centred on two main topics. Nest protection techniques were discussed in the context of previous great bustard nesting attempts in the UK. Experience of bustard nest protection in other countries was shared, as were nest protection techniques for other ground nesting birds in the UK, such as Montagu’s harrier and stone-curlew. The most significant recommendation was that the Project Steering Group should consider catching and hand-rearing the weaker second chick in future breeding attempts, as this is considered likely to die.

The group then discussed the importance of nest monitoring, levels of monitoring of previous nests in the UK, and monitoring techniques employed abroad. It was agreed that the project should employ more intensive nest monitoring techniques, to ensure that we know where all females are nesting (in order to identify threats and achieve the highest possible level of nest protection), how they behave on the nest and how they behave when they are feeding chicks.

Natural England (Somerset)

For this event, we welcomed a team of Natural England staff and volunteers from the Somerset Levels, an area which has supported several wintering great bustards since the beginning of the project. The Project Manager gave a presentation on the LIFE+ project,
and the group were shown around the site, with good bustard sightings. They left well-informed about the project, able to support it particularly by disseminating that information to other conservation practitioners in Somerset.

Technical Working Group No. 2 – From hatching to release; effects on condition and survival

The list of invitees was very different for the second Technical Working Group, which was also chaired by Paul Goriup. There were several vets in attendance, from the Great Bustard Project, the Wildfowl & Wetlands Trust and the Game & Wildlife Conservation Trust. There were also a number of international reintroduction specialists, including Carl Jones of the Mauritian Wildlife Federation, Murray Williams, formerly of the Department of Conservation in New Zealand, and Torsten Langgemach, from the Brandenburg Great Bustard Project in Germany. Once again, the LIFE+ Project Steering Group was fully represented, and staff from the RSPB, the University of Bath and the MoD attended.

The Group were given presentations on the pre-release phase of the UK Great Bustard Project, the Great Crane Project and the rear and release scheme for great bustards in Germany. The following discussions covered the possibility of importing eggs rather than chicks to the UK, the diet of chicks and its effect on their growth, the methods and effects of transporting young birds, the quarantine phase once birds have reached the UK, possible solutions to fox naivety and choices of marking methods.

Agreement was reached on several important topics. It was considered that a trial import of eggs should be attempted, as it seemed clear that the quarantine phase in the UK is particularly detrimental to the success of the rearing process, but also because research of data from 2004-2010 found that birds that were released earlier had a higher survival rate. Modifications to quarantine to reduce its harmful effects were also discussed. It was recommended that diet should be calibrated as closely as possible with the diet of great bustard chicks in the wild, and that the monitoring team should focus on reaching a better understanding of the predation of great bustards once released.
D9: Implement programme of public engagement work

This action includes the running of visits to see Great Bustards in the wild at the project release site. In year one a total of 1,387 visitors came to the site and the number of visits undertaken was 250, meaning an average of 5.5 people per visit. There were also larger group visits that came to the project site including a visit from Writtle College, Essex; the Netheravon Brownies and from Wildlife Holiday Travel, all of these were groups of 12-20 people. Knowing that we can accommodate for larger groups we hope to increase the number of group visits run, as well as the number of people per visit; hopefully catering for groups of up to 30+.
LIFE+ Project “Reintroducing the Great Bustard Otis tarda to Southern England (LIFE09/NAT/UK/020): Year 1 Summary

LIFE+ Action E2: Carry out essential conservation monitoring

Summary

The main aim of the monitoring Great Bustards in the UK is to gain greater knowledge of their ecology, survival and population dynamics, informing conservation management actions and maximising the chances of a successful long-term re-establishment of this species in the UK. This report presents the outcomes of the 2010 release and 2011 breeding season, followed by initial results of the 2011 release. The birds released in 2010 were less successful than the average in previous years, with 82% of birds recovered dead within 6-months following release.

The monitoring team provided guidance on release site selection using a variety of factors important to Great bustard habitat preference and an additional release site for 2011 was chosen with the aim of providing a more suitable environment for newly-released birds. Post-release monitoring suggests higher survival for the first 60-day period following release at the new release site compared to the long-term release site. Compared to previous years, the estimated first 60-day post-release survival of birds released in 2011 has been higher than the long-term average, however a full assessment of the success of the 2011 release and recruitment of birds into the population will not be undertaken until spring 2012, when more information on the survival and behaviour of the birds has been collected. Monitoring data suggest that the post-release mortality is high, and even experienced adults are not fully prepared for rearing their chicks. To improve the survival and future reproduction of released birds, we suggest (i) changing the pre-release conditions to create behaviourally better prepared animals for the release, (ii) considering a third release site, and (iii) improving habitat suitability around the release sites.
1. Introduction

The main aim of the monitoring Great Bustards in the UK is to gain greater knowledge of their ecology, survival and population dynamics, informing conservation management actions and maximising the chances of a successful long-term re-establishment of this species in the UK. The Mid-Term review highlighted that current rates of post-release survival are limiting the growth of the population (Burnside et al., 2011). In the initial three months after release, the birds suffer high mortality, improving after eight months to a level comparable to other populations. Post-release monitoring is essential for improving our understanding of the factors affecting survival, habitat use and rates of population growth; necessary for underpinning a strategy for taking this reintroduction project forward (Burnside et al., 2011).

This report aims to summarise the actions and results taken within the LIFE+ project from August 2010 to November 2011, and set out actions for the monitoring programme in Year 2.

3. Invertebrate communities and habitat type

Adult great bustards are largely vegetarian, with 90% of their diet consisting of green plant material and 7% of invertebrates (Spanish population (Lane, J. C. Alonso, J. a. Alonso, & Naveso, 1999)). In contrast, invertebrates are considered to be essential for chicks for the first three months, when growth rates are highest (Lane et al., 1999; Morales, Juan C. Alonso, & J. Alonso, 2002). In Eastern Germany, low arthropod densities have been suggested to be responsible for the high mortality rate of chicks (B. Litzbarski & H. Litzbarski, 1993, 1996). During a preliminary assessment of the grasslands of Salisbury Plain, invertebrate biomass was considered to be sufficient around the release area to provide sufficient chick food (Osborne, 2005). However, since then, breeding females have been seen to use more arable areas for provisioning chicks, therefore an assessment of the invertebrate abundance and diversity was performed as part of a Master’s thesis (Clarke, 2011).

This assessment found that in an evaluation of four bustard-friendly sites, grassland was found to contain higher numbers of invertebrates than comparable crop areas. One of
the four sites was a designated SSSI; the more traditional management practices used at this site may have resulted in the higher invertebrate biomass at this site in both crop and grassland areas. Coleoptera species, known to be prevalent in chick diets, were more prominent in arable crops than grassland.

5. Pre-release monitoring

Tracking devices

Over the seven releases prior to 2011, birds have been fitted with a range of monitoring devices, including individually-numbered wing-tags, radio tags and satellite transmitters (Table 2). The LIFE+ project provisioned for all released bustards to be fitted with wing-tags or metal rings, in addition to 20 radio tags and 5 satellite transmitters each year; a combination of devices considered to provide high-quality data and allowing birds to be tracked in the field and remotely.

Recent studies have shown that fitting monitoring devices to birds may have negative impacts on their survival (Paton et al., 2011; Steenhof et al., 2006), behaviour (Phillips, Xavier, Croxall, & Burger, 2003; Saraux et al., 2011) and productivity (Peniche et al., 2011). In addition, harness-mounted transmitters have been implicated to lesions (Peniche et al., 2011), reduce body condition and flight performance (Irvine, Leckie, & Redpath, 2007). The Great Bustard Reintroduction Project has been limited by low post-release survival, with predation and collisions being important causes of mortality (Burnside et al., 2011). Although collisions are a major cause of mortality in wild bustard populations (Janss, 2000; Martin & Shaw, 2010), captive-reared individuals may be particularly vulnerable, due to poor feather condition and behavioural naivety (Burnside et al., 2011). In Grey partridges *Perdix perdix*, both hand-rearing and radio-tagging had adverse effects on flight, with birds carrying tags showing decreased take-off angle and climbing rate to un-tagged birds (Putaala, Oksa, Rintamäki, & Hissa, 1997), reducing their ability to avoid predation.

It is generally expected the fitting animals with transmitters will increase their probability of detection in the field and therefore greatly assist with monitoring. However, in a recent analysis of the mortality of released bustards, fitting birds with satellite or radio-transmitters was not found to increase the probability of re-sighting
birds after release (Burnside et al. unpublished data). They were, however, found to assist with the probability of recovering dead birds.

In September 2011, the analysis of the re-sighting data from 2004-2010 suggested that there was a small cost to the birds fitted with backpack-mounted transmitters, with birds carrying backpacks having a 3% lower survival probability between 15-day periods over the first 165 days post-release. Although further analyses did not confirm this initial result, as a precaution, birds released in 2011 only carried one monitoring device each and the numbers of harness-fitted transmitters fitted were reduced in comparison to previous years (Table 2). Although later analyses have suggested that backpack-mounted devices might not be as harmful as earlier thought, the decision was made on the best information available at the time.

Table 2. Summary of tracking devices fitted to birds in all release years.

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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<tr>
<td>Number of released great bustards</td>
<td>22</td>
<td>32</td>
<td>9</td>
<td>6</td>
<td>17</td>
<td>18</td>
<td>23</td>
<td>29</td>
</tr>
<tr>
<td>With wing-tags</td>
<td>22</td>
<td>32</td>
<td>9</td>
<td>6</td>
<td>17</td>
<td>18</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>With transmitters</td>
<td>20</td>
<td>24</td>
<td>9</td>
<td>6</td>
<td>4</td>
<td>18</td>
<td>23</td>
<td>11</td>
</tr>
<tr>
<td>Harness radio-tag</td>
<td>20</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
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<td>Tail mount 11g</td>
<td>8</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Tail mount 19g</td>
<td>12</td>
<td></td>
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<td></td>
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<tr>
<td>Necklace 19g</td>
<td>4</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Harness PTT GPS</td>
<td></td>
<td></td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>15</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Without transmitters</td>
<td>2</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>18</td>
</tr>
</tbody>
</table>

Tracking devices used in other avian projects

Monitoring devices such as satellite transmitters, GPS loggers, accelerometers and radio-tracking have advanced significantly over the last couple of decades, particularly in the size and weight of devices. In the Great Bustard Reintroduction Project we do not intend to re-capture individuals after release, therefore it is important that we can collect data from loggers remotely. Table 3 gives examples of projects utilising monitoring devices; devices requiring birds to be re-captured for data download have been excluded. From this review, it is clear that we are already using the primary tracking technology used by other avian projects globally.
Table 3. A sample of avian projects using monitoring devices to record bird movements and behaviour.

<table>
<thead>
<tr>
<th>Species</th>
<th>Device</th>
<th>Weight</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>African waterfowl (Mali, Malawi &amp; Nigeria)</td>
<td>Harness-mounted solar-powered PTTs (Microwave Telemetry Inc.)</td>
<td>12g – 30g</td>
<td>(Cappelle et al., 2011)</td>
</tr>
<tr>
<td>Red Kite <em>Milvus milvus</em> (UK Reintroduction programme)</td>
<td>Harness-mounted single cell TW-5 radio transmitters (Biotrack); Tail-mounted single cell TW-3 radio transmitters (Biotrack)</td>
<td>29g; 18.5g</td>
<td>(Peniche et al., 2011)</td>
</tr>
<tr>
<td>Raptors (Osprey <em>Pandion haliaetus</em>, Honey buzzard <em>Pernis apivorus</em>, Marsh harrier <em>Circus aeruginosus</em>, Eurasian hobby <em>Falco subbuteo</em>) (Africa)</td>
<td>Harness-mounted battery-powered PTTs (Microwave Telemetry Inc.)</td>
<td>20g</td>
<td>(Hake, Kjelle, &amp; Alerstam, 2003; Strandberg, Klaassen, Hake, &amp; Alerstam, 2010)</td>
</tr>
<tr>
<td>Bonelli’s eagle <em>Aquila fasciata</em> (Spain)</td>
<td>Harness-mounted Argos/GPS PTT-100s (Microwave Telemetry Inc.)</td>
<td>30g, 35g, 45g</td>
<td>Duty cycles: 8hrs on/120hrs off or 16hrs on/72hrs off (Cadahía, López-López, Urios, &amp; Juan José Negro, 2010; Cadahía et al., 2008)</td>
</tr>
<tr>
<td>Lesser Black-backed gull <em>Larus fuscus</em> (Europe)</td>
<td>Harness-mounted solar-powered PTT (Microwave Telemetry Inc.)</td>
<td>18g</td>
<td>(Pütz et al., 2008)</td>
</tr>
<tr>
<td>Keel-billed toucan <em>Ramphastos sulfuratus</em> &amp; Chesnut-mandibled toucan <em>Ramphastos swaisonii</em> (Panama)</td>
<td>Harness-mounted backpack containing GPS (E-Obs, <a href="http://www.e-obs.de">www.e-obs.de</a>), 3-axis accelerometer, remote data readout, VHF radio transmitter</td>
<td>17g</td>
<td>Location fix every 15 minutes; VHF transmitter allowed field workers to approach birds, data could be downloaded at distance of 200m (Kays, Jansen, Knecht, Vohwinkel, &amp; Wikelski, 2011)</td>
</tr>
<tr>
<td>Turkey vultures <em>Cathartes aura</em> (USA)</td>
<td>Harness-mounted solar-powered PTT (Microwave Telemetry Inc.) &amp; interperitoneal data loggers (Biometistics)</td>
<td>70g</td>
<td>Transmitters attached with unwaxed dental floss, which will naturally rot away after several seasons (Mandel, Bildstein, Bohrer, &amp; Winkler, 2008)</td>
</tr>
<tr>
<td>Species</td>
<td>Device</td>
<td>Weight</td>
<td>Additional information</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------------------------------</td>
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<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Griffon vulture <em>Gyps fulvus</em></td>
<td>University of Amsterdam (UvA) Bird Tracking System (UvA-BiTS) GPS devices; Harness-mounted, solar-powered with rechargeable batteries and two-way communication to ground station network</td>
<td>40 – 50g</td>
<td>Data downloaded via 5 relay antennas, installed at the main feeding stations</td>
</tr>
<tr>
<td>Lesser Black-backed gull <em>Larus fuscus</em></td>
<td>University of Amsterdam (UvA) Bird Tracking System (UvA-BiTS) GPS devices; Harness-mounted, solar-powered with rechargeable batteries and two-way communication to ground station network</td>
<td>12 – 19g</td>
<td>Data downloaded at breeding colony relay station</td>
</tr>
<tr>
<td>Asian Houbara bustard <em>Chlamydotis macqueenii</em></td>
<td>Harness-mounted solar- and battery-powered PTT (Microwave Telemetry Inc.)</td>
<td>30 – 45g</td>
<td>Birds captured weighing &lt;700g fitted with VHF transmitters and recaptured at a later date for PTT attachment; 10hrs on/21 hrs off duty cycle (Combreau, Riou, Judas, Lawrence, &amp; Launay, 2011)</td>
</tr>
<tr>
<td>Little bustard <em>Tetrax tetrax</em></td>
<td>Harness-mounted TWR-1AA VHF radio transmitters (Biotrack)</td>
<td>&lt;4% body mass</td>
<td>Bustard hens captured using funnel (Lapiedra, Ponjoan, Gamero, Bota, &amp; Mañosa, 2011)</td>
</tr>
<tr>
<td>Great bustards <em>Otis tarda</em></td>
<td>Harness-mounted TW3 2xAA battery VHF radio transmitters (Biotrack)</td>
<td>60g</td>
<td>Captured by chasing down when young and with mother (Magaña et al., 2010)</td>
</tr>
<tr>
<td>Osprey <em>Pandion haliaeus</em></td>
<td>Harness-mounted solar-powered satellite transmitter</td>
<td>30g (1.6% of body mass)</td>
<td>Location fixes every hour depending on battery charge <a href="http://www.rspb.org.uk/">http://www.rspb.org.uk/</a></td>
</tr>
<tr>
<td>Cuckoo</td>
<td>Harness-mounted</td>
<td>5g</td>
<td>Duty cycle: 10 Chris Hewson, BTO</td>
</tr>
</tbody>
</table>
**LIFE+ Project “Reintroducing the Great Bustard Otis tarda to Southern England (LIFE09/NAT/UK/020): Year 1 Summary**

<table>
<thead>
<tr>
<th>Species</th>
<th>Device</th>
<th>Weight</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>(BTO project; UK - Africa)</td>
<td>solar-powered satellite transmitters (Microwave Telemetry Inc.)</td>
<td>hrs on/48 hrs off; daily updates using Argos positioning algorithms</td>
<td></td>
</tr>
</tbody>
</table>

| Alcids (Common guillemot *Uria aalge*, Brünnich’s guillemot *Uria lomvia*, Tufted puffin *Fratercula cirrhata*) | Implantable PTT with 200mm external antenna (Microwave Telemetry Inc.) inserted into the abdominal cavity through a mid-ventral incision | 35g | High mortality of instrumented birds, especially 11-20 days post-release. (Hatch, Meyers, Mulcahy, & Douglas, 2000) |

| Pacific Black Brant *Branta bernicla nigricans* (Alaska) | Battery and solar-powered GPS transmitters fitted using a subcutaneous anchor method | 30g | GPS data was collected via a high-speed VHF data transmission from a light aircraft with two-element yagi-antennae (Lewis & Flint, 2008) |

| New Caledonian crow *Corvus moneduloides* (New Caledonia) | Tail-mounted camera units with VHF radio-tags | Tail-mounted to ensure safe shedding of tag with regular moult | |

| Trumpeter hornbills *Bycanistes bucinator* (South Africa) | Backpack-mounted GPS loggers (e-obs GmbH, Munich) – data downloaded to a handheld base station through a radio link. | 27g | Backpack: Teflon strings with predetermined breakage points as backpack straps, allowing loggers to drop off eventually; Battery lasted for 18 days, sampled location at 15 minute intervals in daytime (Lenz et al., 2011) |

Tracking devices under consideration for 2012 release

In the most recent analysis of the effect of pre- and post-release factors on mortality, fitting transmitters via backpack harnesses was not found to significantly reduce the survival of birds (Burnside et al. unpublished data). Therefore, in 2012 we recommend that the satellite transmitters purchased by the project (Table 3) are used on backpack harnesses, but with greater considerations given to their deployment:

1) Backpacks harnesses not to be fitted to more than 50% of released birds and data collected through monitoring used to compare any differences in the behaviour and survival of birds released with and without backpack harnesses.

2) Given recent evidence in other species that harnesses can cause injuries (Peniche et al., 2011), we recommend that the project vet thoroughly examines carcasses for sub-cutaneous damage.

3) The harnesses used have been fitted by Professor J.C. Alonso and follow the Spanish design, with an estimated lifespan of 7 years before they fall off. Our longest running PTT system for males has been 4 years and 2 years for females; therefore, the structure of the backpack harnesses will be re-assessed to minimise their effect on birds post-release. The design will include a breakaway system (Lenz et al., 2011), allowing the harness and the device to fall off the bird, without entanglement. This will prevent birds from being encumbered with tracking devices once their battery has expired.

In addition, we will investigate the use of a radio-transmitter in conjunction with the satellite transmitters; to aid location of birds in the field. In 2011, we have found the radio-transmitter necklaces deployed on females to perform poorly, but will test other brands of radio tags to determine their relative success. Lightweight radio tags could be mounted onto the existing satellite transmitter units without much additional cost, allowing us to identify individuals in the field without the use of wing-tags.

We are currently investigating some lighter tracking devices that may not require backpack harnesses. These devices, including GSM units from Cellular Tracking Technologies, will be tested on captive birds in January/February 2012, allowing sufficient time for the ordering and manufacture of devices for the release periods. Cellular tracking systems store location data from a GPS receiver and transmit this data over a GSM network; many devices integrate data-logging and transmission technology,
where data are logged, stored, then transmitted after a period of time (Bridge et al., 2011). However, GPS/GSM devices are a recent addition to tracking technology and have not yet benefitted from the levels of miniaturisation that other device types have. However, 27g GPS/GSM devices have recently been tested on wild birds, and smaller devices of c. 15g are currently under development. Cellular technology allows the device to update frequent batches of telemetry data at considerably low cost compared to satellite devices; when cellular coverage is unavailable, the unit stores data points (>100,000) until it returns to a coverage area.

We are currently in discussions with Christian Rutz (Behavioural Ecology Research Group, University of Oxford) over mounting video tags to released Great bustards to investigate the behaviour of newly-released individuals in response to predators. Video cameras are now sufficiently small and lightweight to deploy on many terrestrial species, giving an animal’s eye view of the environment (Rutz et al., 2007). A backpack-mounted video tag with a laterally-orientated camera allows the analysis of wing dynamics during flight, whereas a tail-mounted tag with a forward facing camera permits the recording of foraging behaviour, social interactions and physiological parameters (e.g. breathing and defecation rates) (Bluff & Rutz, 2008). Christian Rutz and colleagues have used video tags of his own development extensively on New Caledonian crows to investigate tool use and social behaviour with great success. Tail-mounted tags are attached to tail feathers and drop naturally with the feather; by targeting the moulting season of the study species the tags are shed within days or weeks after deployment. An integrated VHF radio tag is essential for capturing video footage, enables recovery of shed tags and provides positional data for linking video-recorded behaviour to certain habitat patches. For New Caledonian crows, video footage is captured with tracking teams consisting of one ‘controller’ who uses VHF radio telemetry to located the animal and anticipate its further movements and 1-2 assistants who operate video receivers. The controller instructs assistants via walkie-talkie on where best to position video receivers and how to orient parabolic antennae to maximise reception. The VHF transmitter of the integrated video tags lasts for three weeks, enabling collection of radio fixes for conventional home-range and habitat-use analysis. Information on bustard behaviour gained through video tracking or time-lapse photography may be crucial for optimising release strategy and improving post-release survival. Discussions concerning the specification of the video tracking systems will take place in January.

Table 3. Status of Microwave Telemetry Inc. LC4 PTT units; for the release in 2012 we have 8 female 40g transmitters and 10 male 105g transmitters available.
Pre-release condition

After the 30-day quarantine period, birds are captured to fit monitoring devices and record biometric data. The quarantine facilities for imported chicks have undergone some improvements over duration of the project, including windows in 2011; however, with greater number of chicks being imported the space per chick may have declined over this period. There was a significant difference in the post-quarantine weights of chicks with release year, after controlling for the date of release and sex; chicks in 2004 and 2011 were significantly lighter than those in 2005 – 2010 (GLM with quasi-poisson
errors: $F_{5,125}=8.9$, $p<0.001$; Figure 1). However, this may be explained by differences in the age of chicks at release, rather than differences in quarantine care or diet. Between years there have been differences in the quality of the birds’ tails after the quarantine period and in 2005 and 2010 tail length was not recorded.

![Figure 1](image.png)

**Figure 1.** Mean mass of birds at the end of the 30-day quarantine period by release year and split by sex. Females are represented by dark grey bars, males by light grey bars. Errors shown are ±1 S.E. and sample sizes shown in brackets.

In 2011, we also took photographs of the wings and tail of all birds after quarantine and before release from the soft release pens to provide information on the feather quality of birds at these periods. This will be used to investigate changes in feather quality during the soft release period and whether feather condition is an important factor in post-release survival.
6. Release strategy

Many reintroduction projects aim to facilitate acclimatisation by holding individuals at the release site for a period with the aim of reducing dispersal or mortality; however, these strategies often do not have the desired effect (Armstrong & Seddon, 2008). From 2004, release group sizes have been variable (range: 6 – 32 birds), with birds being released in either one (2004, 2006-2009) or two release events (2005). In releases from 2004 to 2008, birds have been ‘hard’ released, where they have been released straight into the centre of the large release pen at Release Site 1 following the quarantine period. However, given the high initial post-release mortality of released birds, all of the birds were ‘soft’ released in 2009 and there was a 50:50 split in 2010, with half the birds being ‘soft’ released and half being ‘hard’ released. In 2010, birds were assigned randomly into four groups; two ‘hard’ release groups which were released into the pen immediately from the quarantine area and two ‘soft’ release groups which were kept in soft release pens for up to two weeks. In 2011, birds were separated into two groups and placed into three soft release pens at each of the two release sites; birds were released by opening the pen door and allowing them to leave freely after 7 days. There has been progression in the ‘soft’ pen structures used; away from netting off an area of the large release pen and towards free-standing structures (Figure 2).
The number of birds released by these two methods in 2009 and 2010 has been too small to see any clear difference in their survival (2009: ‘hard’=14 birds, ‘soft’=8; 2010: ‘hard’=5, ‘soft’=13; Figure 3). However, further analysis may be able to determine whether release strategy has had an effect on the dispersal of birds away from the long-term release site.

A recent analysis has shown that release date is one of the most important factors contributing to post-release mortality (J. Burnside, pers. comm.), with birds released earlier having a greater probability of surviving the first 165 days following release. This suggests that these soft release pens come too late, as individuals have already spent their first months in a highly claustrophobic environment. It is hoped that the soft pens and release pen will override this previous experience; however, a sufficient number of birds have been observed walking and feeding along fence lines, together with being recovered dead after collisions with fences, to suggest that they do not. However, by importing chicks hatched in Russia the project has been limited to how quickly they can release birds due to Defra quarantine requirements.
7. Post-release monitoring

The Monitoring Officer was employed in February 2011, therefore post-release monitoring of 2010 birds was carried out by project staff and volunteers prior to this time. Data on birds post-release comes from four main sources:

1. Observations by the Monitoring Officer, LIFE+ project staff and monitoring volunteers
2. Satellite transmitter data
3. Sightings reported by landowners and farm workers around the release sites to LIFE+ project staff
4. Sightings reported by members of the general public through the Great Bustard Group website or telephone

In all years, re-sightings reported by members of the general public have been very important in locating birds, especially those without tracking devices and travelling outside the main release area(s). Sightings reported via telephone or the Great Bustard Group website have been followed up by LIFE+ project staff, with interesting reports leading to visits to the area to locate and identify the individual(s). From September 2011 to December 2011, there have been eight monitoring volunteers assisting the Monitoring Officer, together with LIFE+ project staff, to keep track of the birds, particularly around the release sites.

Post-release mortality in 2010 – 2011

In 2010, twenty-five birds were imported from Russia and of these, twenty-two birds were released in four cohorts: 5 birds released on the 9th September 2010, 6 birds released on the 24th September 2010, 6 birds released on the 3rd October 2010 and five birds released on 10th October. Some of these birds were later recaptured due to injuries and released subsequently (Appendix, Table A1).
Sixteen of the birds released in 2010 were fitted with satellite transmitters, aiding re-
sightings and recovery of carcasses; of those released, we regularly see two birds, both
of which do not carry satellite transmitters. Many of the birds released in 2010 died in
the first six months following release (82% of 22 birds released), with deaths being due
to both predation (39%) and collision (33%; 28% unknown). The birds recovered dead
were found on average 9.0km (±7.19km; 11 recoveries) away from the release site; this
compares to a 2004-2009 average of 6.2km (±3.79km; 21 recoveries). The rate of loss of
the 2010 birds in the first 60 days post-release was second greatest of all releases to date,
with survival probability from release to 60 days being 31.6% (±10.6%), compared to a
long-term average of 47.0% (2004-2009; ±13.5%; Figure 4).

In 2011, sixteen birds were released at the long-term release site (12 females, 4 males)
and thirteen were released at the new release site (7 females, 6 males; Appendix, Table
A2). Compared to previous years, birds released in 2011 showed slightly higher survival
from release to 60 days post-release than average (Kaplan-Meier survival model - 2011:
57.1% ± 9.3%; 2004-2009: 47.0% ±13.5%; Figure 4). Those released at new release site had
significantly higher survival to 60 days post-release than those released at the long-term
release site (Kaplan-Meier survival model – Release Site 1: 40.0% ±12.6%; Release Site 2:
76.9% ±11.6%). However, these estimates are based on carcass recoveries; over this 60-
day period there was a decline at both sites in the number of birds observed on a daily
basis, therefore birds not observed may have died and have not been recovered.
From release to December 2011, eleven birds of twenty-nine released in 2011 were recovered dead. Predation was the main cause of death of birds at Release Site 1 (67% of 9 birds), with collision-related injuries resulting in comparatively fewer deaths (11%); 22% of deaths were difficult to classify and may have been due to either predation, collision or collision followed by predation.

A preliminary assessment of Red fox *Vulpes vulpes* density around the release site area has suggested that the highest density is in the valley where the release pen is situated (A. Weldon, pers. comm.), which may be due to a high density of the main prey species (European wild rabbit *Oryctolagus cuniculus*), but also the topography of the landscape. The majority of the carcasses recovered from around Release Site 1 have been in the valley where the release pen is situated (Figure 5); this valley may act as a corridor facilitating the movement of foxes (A. Weldon, pers. comm.). At Release Site 2, there were two carcasses recovered: one was a collision-related injury with the release pen fence, the other a collision-related injury, possibly with power lines near to the release site.
Furthermore, the release pen fence at Release Site 1 and surrounding barbed wire fences were not only a cause of mortality to birds released in 2010 and 2011 (see Tables A1 and A2 in Appendix), but significantly hindered movement of birds; this was also a problem with the temporary release site fencing at the new release site in 2011. Generally newly-released birds returning to the fenced areas would not fly back in, but attempt to walk back. Without a gating system employed (for further details see release site management report) birds could not return to their conspecifics inside the pen without flying, resulting in birds remaining by fence lines, potentially increasing mortality through predation. For releases in 2012, options for allowing birds to return to the group after leaving the fenced area without disturbance will be determined before birds are released.

**Movements and behaviour of released birds**

Of the two release sites in 2011, birds used the new release site more widely than those at Release Site 1 (Figure 7); however, at both release sites the majority of the land was not used by the birds.
In 2010, birds dispersed further from the release with days from release (LME with log-transformed response and Bird ID as random effect: Days from release: $F_{1,2378}=3721.0$, $p<0.001$), with two birds, a male and a female, travelling c.90km in a South-West direction to the South coast separately (Figure 8). Similarly in 2011, only a small proportion of birds have remained faithful to their release site areas; 2 of the Release Site 1 birds (of 6 current birds, excluding a pinioned bird) and 2 of the Release Site 2 birds (of 11 current birds) are seen regularly around the sites. Birds from both release sites in 2011 have travelled in a South-West direction to the coast (Figure 8); with one bird travelling c. 180 km from its release site to Devon. In both 2010 and 2011, birds dispersing away from their release sites have done so individually; a trend which has been commented on in previous years.

8. Discussion

Although post-release mortality has acted as a constant limiting factor on the reintroduction project, individuals from each release year survived to adulthood (Burnside et al., 2011). The initial post-release mortality of individuals released in 2010
was higher than any other release year so far; however, at least two individuals from this year have been recruited into the adult population. As in previous years, predation by foxes and collisions with fences were still major causes of mortality in newly-released birds, which may be due to the release site location. Releasing birds at a new release site has resulted in higher initial post-release survival than the long-term average. Although it is still too early to assess the long-term success of this site in comparison to the long-term site, this initial success is encouraging. A release site with a reduced predator population and few fence lines may allow young birds to learn about their environment in a comparatively risk-reduced area. However, despite employing a different release methodology and a more suitable release site in 2011, both designed to tie birds to their release area more successfully than in previous years, birds still dispersed from their release sites. An additional aim of our release protocol in 2011 was to assist social cohesion by keeping small groups of birds consistent throughout the chick period; once released, however, generally birds dispersed individually, analogous to previous release years. It is hoped that for next year’s release we can create smaller family groups, which may remain consistent post-release and it is this conspecific attraction that will tie birds to their release site. A full assessment of the success of the release sites in 2011, together with updated population modelling, will be performed in spring 2012, six months after the 2011 release.

In addition to monitoring individuals in the field and providing information on their movements and behaviour, habitat suitability modelling will be utilised in 2012 to give greater knowledge of the habitat preferences of Great bustards in the UK. This will be useful for habitat management actions and for assessing new release sites over a wider area. Population modelling assessments will also be updated, taking into account more recent data. As predation is still a major factor in the mortality of newly-released birds, more monitoring of predator populations in the release areas will be undertaken using camera traps.

It is anticipated that there will be at least one breeding female in 2012, possibly two. Females of breeding age will be intensively monitored leading up to the breeding season, to learn about their nest site selection behaviour. Results from an undergraduate project investigating breeding behaviour of males and females and the effect of disturbance on incubating and chick-rearing females will help to inform research aims for the 2012 breeding season.

Overall, the scientific research effort has been focussed on the behaviour of the birds post-release; more effort is needed to assist with the pre-release rearing and release strategy. A review of the work done by a wider range of reintroduction and
translocation projects is needed to develop ideas and recommendations for this project. A research project for a master’s student during the captive chick-rearing period may also provide more information on how chick-rearing methods can be improved and will be discussed.

Given the research goals outlined in Action E2, much of the focus of 2011 has been on collecting data on birds in the field. However, this has left little time for analysis and recommendations from this work. In 2012, research will be more focused on several topics key to the success of the reintroduction project; a summary of the actions of the monitoring programme for Year 2 are shown in Table 4.

Table 4. Summary of monitoring programme actions for LIFE project Year 2 (2011-2012)

<table>
<thead>
<tr>
<th>Action</th>
<th>Expected Outcome(s)</th>
<th>Timescale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Distribution and habitat suitability modelling – including topographical variables, man-made structures, habitat types.</td>
<td>Guidance on release site placement and habitat management planning (areas and habitat types)</td>
<td>November 2011 – May 2012</td>
</tr>
<tr>
<td>2) Comparison of 2011 release site success: survival and movements of birds</td>
<td>Guidance on future release site selection and management</td>
<td>A full assessment will be made after spring 2012, when birds would be expected to return to their natal site for the breeding season.</td>
</tr>
<tr>
<td>3) Update population modelling for Great bustards in the UK</td>
<td>Up-to-date population estimates; an excellent tool for assessing project success</td>
<td>Population modelling will be updated each spring, when birds would be expected to return to their natal site for the breeding season.</td>
</tr>
<tr>
<td>4) Assessment of the effect of the relatedness of released birds on population structure, behaviour and survival</td>
<td>Supporting population modelling</td>
<td>After completion of genetic work by Paul O’Donaghe at the University of Chester</td>
</tr>
<tr>
<td>5) Predator population estimation and spatial analysis</td>
<td>Greater knowledge of release site predator populations and more effective predator control management strategies</td>
<td>January 2011 – January 2012 Analysis may form part of a final-year undergraduate dissertation.</td>
</tr>
<tr>
<td>6) Nest site prospecting by breeding females</td>
<td>Guidance on female habitat preference for nesting in the UK</td>
<td>Observations in spring 2012</td>
</tr>
</tbody>
</table>
References


Osborne, P. E. (2005). Key issues in assessing the feasibility of reintroducing the great bustard Otis tarda to Britain. Oryx, 39(01), 22-29. doi:10.1017/S0030605305000050


E3: Network with other projects

The Project Manager and other project staff will develop and maintain strong links with relevant projects elsewhere throughout the project period. In doing this, they will build on the relationships that are already in place between the project partners and colleagues working on great bustards in continental Europe and Russia.

The first project networking trip to visit the Austrian LIFE+ Project [LIFE09/NAT/AT/000225] took place in April 2011.