Averting the extinction of bustards in Asia

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The inherent defencelessness against natural predators of bustards, which have relatively small bills and can neither perch in trees nor take refuge in water at night, renders them warier than other large-bodied birds. They are therefore dependent on large areas of little-disturbed, little-developed open country within which they can see and keep danger at a good distance. In Asia (here including Central Asia and Asian Russia), six species—Little Bustard *Tetrax tetrax* (IUCN global category Near Threatened), Great Bustard *Otis tarda* (Vulnerable), Asian Houbara *Chlamydotis macqueenii* (Vulnerable), Great Indian Bustard *Ardeotis nigriceps* (Critically Endangered), Bengal Florican *Houbaropsis bengalensis* (Critically Endangered) and Lesser Florican *Sypheotides indicus* (Endangered)—are already at serious risk of extinction. Great Bustard (of the nominate race) is struggling to survive in Asian Russia (<200 individuals), Kazakhstan (100–1,000) and China (maximum 52 seen in extensive surveys, 2014–2016), while in Asian Russia the eastern race *dybowskii* numbers just 380–430 (with only 5% in protected areas), fewer than 1,000 in Mongolia and 600 in China. Little Bustard is now largely restricted to Kazakhstan and westernmost Asian Russia and, although its status evidently improved in the 1990s with the post-Soviet abandonment of agriculture in Central Asia, re-intensification of farming is poised to cause new declines. Asian Houbara has a population claimed to be between 50,000–100,000 individuals, but is certainly declining despite large-scale captive breeding programmes, with one study suggesting an offtake of 27.1% in the years 1994–2008 when the maximum sustainable level was 7.2%, and another indicating a current annual population decline in Uzbekistan of 9.4%. Great Indian Bustard (<200 birds in the most recent assessments, some in unviable habitat fragments), Bengal Florican (225–249 males estimated for South Asia; several hundred in Cambodia) and Lesser Florican (270 males estimated in 2017 compared with 1,103–1,765 in 1994–1999) are all in extreme trouble. Habitat change, chiefly in the form of rapid and widespread agricultural intensification (mechanisation, chemical applications, overgrazing, increased fencing and new choices of crop), but also involving infrastructure developments and disturbance, is probably the single biggest threat; only the semi-desert-dwelling Asian Houbara remains relatively unaffected. Hunting and poaching is a particularly serious threat to Great and Little Bustards and Asian Houbara, as well as Great Indian Bustard. Powerlines are known to have killed and injured birds of five of the six species and currently are the most serious cause of mortality to Great Indian Bustards, and problems caused by powerlines are anticipated to intensify for all species. Predation, most seriously by uncontrolled dogs, has been registered as a strong negative influence on Great Bustard and seems likely also to affect Little Bustard, Great Indian Bustard and both floricans. The long-term prospects of all six species are extremely bleak unless their conservation is prioritised and significantly strengthened. Adult survival and productivity are key to the health and recovery of bustard populations and both need to be improved through well-managed nature reserves (organised along flyways for long-distance migrants), plus: special protection of areas where males display and around which females are known or expected to breed; continuous unfragmented landscapes subsidised for low-impact farming with reduced grazing pressure within which the birds' social dynamics are unconstrained; the strategic planting of crops favoured by all species; strict and strong regulation of both powerlines and fencing within and beyond those landscapes; equally strict and strong control of hunting, poaching, dog predation and inappropriate grass-fires; and sustained campaigns of public awareness and engagement. The model of Castro Verde Special Protection Area in Portugal, where Great and Little Bustard numbers have multiplied and the livelihoods of communities have been supported through subsidy, provides evidence that practical solutions are possible. Detailed cataloguing of records and intensive biological research programmes are also needed for all species, together with support for local conservation groups and scrupulous review of all landscape-related plans to prevent adverse developments. Hunting of Asian Houbara must come under national systems of control based on an internationally agreed strategy. Governments must now prioritise the conservation of bustards as the burden of responsibilities is too great for NGOs to bear alone. International coordination and collaboration will, with high levels of communication, be crucial to success. The setting of time-bound targets is required to spur key staff into rapid action.

INTRODUCTION

The conservation of bustards (Otididae) is a major global challenge. As large birds of open grassland and dryland habitats, they are attractive to hunters, both animal and human, while their lack of a hind toe, although an advantage for cursorial species, renders them incapable of perching in trees to escape ground predators, and their small feet and weak bills render them physically defenceless. In consequence, they have evolved an extreme wariness as their main form of self-defence. However, this behaviour is largely incompatible with the levels of disturbance and infrastructure development which now commonly affect their habitats. Even the structure of a bustard's head, with eyes arranged for >300° vision to boost vigilance, is today a maladaptation in landscapes increasingly divided up by fencing and intersected by powerlines, which flying birds are ill-equipped to see clearly in frontal vision (Martin & Shaw 2010). Although certain bustard species tolerate or even favour the conversion of natural grassland to low-intensity farming, the widespread modern phenomena of agricultural mechanisation, overgrazing, biocides, roads, fencing, powerlines and wind turbines cause them to disappear rapidly from terrain where they once thrived (Collar 1996). With hunting and dog predation added to these pressures and their naturally low reproductive rates further compounding the problems, it is perhaps unsurprising that, of the 26 species currently recognised worldwide, eight (31%) are threatened and seven (27%) are Near Threatened, rates two to three times higher than for birds in general (BirdLife International 2017).

The situation is most serious in Asia: of the six species recorded in the region, five are listed as globally threatened—Great Indian Bustard *Ardeotis nigriceps* and Bengal Florican *Houbaropsis bengalensis* Critically Endangered, Lesser Florican *Sypheotides indicus* Endangered, Great Bustard *Otis tarda* and Asian Houbara *Chlamydotis macqueenii* Vulnerable—while the sixth, Little Bustard *Tetrax tetrax*, is Near Threatened. All five threatened species continue to decline, despite their long-term red-listing: Great Indian Bustard, Bengal Florican and Lesser Florican are now in the greatest danger of global extinction, whilst the two races *tarda* and *dybowskii* of Great Bustard are at very high risk of regional and global extinction respectively, Asian Houbara continues to decline ineluctably and even Little Bustard is poised to decline in the near future.

There is little evidence that conservation measures implemented for these taxa in Asia have yet been effective in arresting their decline; indeed, the accumulating evidence is that a comprehensive new initiative for the restoration of bustard populations in Asia is urgently needed. In this review we summarise each species's status and trends in the region and then use this evidence to inform the radical solutions that may yet secure the regional and global futures of all six species.

Three of the six—Little Bustard, Great Bustard and Asian Houbara—are members of the Palearctic fauna; the other three—Great Indian Bustard, Bengal Florican and Lesser Florican—are endemic to the Oriental or Indo-Malayan biogeographic region. Our definition of 'Asia' here includes Central Asia northwards from the western boundaries of Pakistan and China and includes Afghanistan, Turkmenistan, Uzbekistan, Kazakhstan, Tajikistan and Kyrgyzstan, as well as 'Asian Russia' (east of a longitudinal line through the Ural Mountains south to the Kazakhstan border), Mongolia and China. This excludes Iran and the important European populations of Little and Great Bustards breeding in the lower Volga region of Russia (see, e.g., Moseykin 1992, Shlyakhtin *et al.* 2004, Oparina *et al.* 2014, 2016). However, some Asian breeding populations of the Palearctic species winter in Iran and other parts of the Middle East, where they face considerable threats, and we briefly cover these populations and their associated threats under the heading 'Extralimital'.

We first consider the evidence for population decline and current conservation assessment of each species by country. For Great Bustard, Great Indian Bustard, Bengal Florican and Lesser Florican the detailed conservation assessments of *Threatened birds of Asia* (BirdLife International 2001) are used as a baseline. However, the Great Bustard races *tarda* and *dybowskii* are treated separately, partly because of the possibility that they are two species (Kessler *et al.* in revision) and partly because the presence of both taxa in China is a potential source of confusion, although no overlaps in range are known (Jiang 2004). Similar treatment for the two Bengal Florican races (nominate *bengalensis* in South Asia, *blandini* in Indochina) is not deemed necessary. The Little Bustard and Asian Houbara, both classified Near Threatened when BirdLife International (2001) was published, received only brief mention therein; summaries of the evidence for their population declines up to 2000 are included here as a baseline complementing the treatment of the other species.

Taxonomy, nomenclature and sequence follow del Hoyo & Collar (2014).

POPULATION STATUS OF ASIAN BUSTARDS

Little Bustard *Tetrax tetrax*

A review of old literature indicated that huge numbers were formerly found in Central Asia and large declines occurred between the mid-1930s and 1960s, after which there is little information (Schulz 1985). Numbers in BirdLife International (2017) are informed guesses conflated from expert opinion: there could be >20,000 individuals in European and Asian Russia combined and a breeding population of about 20,000 in Kazakhstan, although given the estimate of 75,000 in eastern Orenburg and the wintering numbers in Azerbaijan these figures are thought to be increasing and probably an underestimate.

Asian Russia. Populations today appear mostly small and scattered, with no reliable information on size and trends; population assessments in European and Asian Russia are conflated and therefore unusable in this review. Historically the species occupied steppe and farmland from the Urals to the Altai range, with declines noted before 1950 (Dement'ev & Gladkov 1951), and it disappeared entirely from Asian Russia by 1980 owing to steppe conversion and agricultural intensification (Beme *et al.* 1987); post-Soviet large-scale arable land abandonment, with a return from intensive to 'extensive' (low-impact) agriculture and regenerating grasslands, led to re-colonisation of parts of the region and the re-establishment of near-extinct populations (Antonchikov 2011, Nefedov 2013a, Korovin 2014). The eastern part of Orenburg province is considered a key breeding area, with a possible provincial population of 75,000 birds (Fedosov *et al.* 2017). In southern Chelyabinsk province it was 'common' in the 1990s (Zakharov & Ryabitsev 2008) and in 2000–2010 the mean population density in the northern agricultural landscapes, on the eastern flanks of the Urals, exceeded 2 birds per km², with highest densities in fallows and perennial grass crops (Korovin 2014). Small numbers are found in other provinces on the northern Kazakhstan border: numbers are recovering in Tyumen (Tarasov & Primak 2013) and five areas of Kurgan (Tarasov 2012), breeding occurs in Novosibirsk near the Kazakhstan border (Nefedov 2013a), Omsk was recently thought to hold 25–30 pairs (Nefedov 2013b) and 'a few dozen' recolonised Altai Krai after 2007 (Irisova & Kotlov 2016).

Kazakhstan. In the early 1900s the species was common on natural steppe in the north and east, with flocks of 200–300 birds, but large-scale conversion of steppe to arable land and increased hunting caused declines by the 1950s (Gavrin 1962). In the last 20 years local breeding populations have re-established (Gubin & Karpov 1999, Berezovikov & Anisimov 2002, Vilkov 2003) and birds are 'common' in South Kazakhstan region (Shakula *et al.* 2017). These reports match increases in other grassland species attributed to post-Soviet agricultural abandonment (Kamp *et al.* 2011). Mean breeding density (81% males) in April/May 2011 on 3,185 km of driven transects in Karaganda and Kostanay regions was estimated to be 0.30 birds per km², with 1.35 per km² in old and recently mown perennial grass fields, 0.53 per km² in abandoned arable fields, 0.26 birds per km² in pristine steppe, and only 0.07 birds per km² in active arable fields (Koshkin 2011). The Kazakhstan population is reported to be about 20,000 birds (BirdLife International 2017), but a return to intensive agriculture is anticipated to cause declines in the near future (Kamp *et al.* 2011).

China. The population, on the fringe of its range, is probably less than 1,000 birds, mainly restricted to the north-west (Xinjiang province) and north (Ningxia Hui autonomous region); it has disappeared from north-west (Tien Shan foothills) and southern Xinjiang (Gao *et al.* 2008). In September 2015, 2016 and 2017 survey teams found over 100 birds in Tacheng region, Xinjiang (Xiangyu Guan pers. comm.). Nationally, the species is classified 'data deficient' (Jiang *et al.* 2016).

Extralimital. In the 1930s wintering numbers in Azerbaijan were so large that some 50,000 birds were estimated to be hunted annually (Gauger 2007). Agricultural intensification, which has badly affected European populations (Delgado & Moreira 2010, Bretagnolle *et al.* 2011, Lapiedra *et al.* 2011), caused a significant decline in Russian and Kazakhstan breeding areas in the 1950s, with 20 million ha of steppe converted to agriculture, but in the 1990s after the break-up of the Soviet Union 'millions of hectares' reverted to fallows, with marked reductions in pesticide use and livestock levels, such that surveys in 2005–2006 estimated 150,000–200,000 wintering birds in Azerbaijan (Gauger 2007). Likewise, in Iran, in a narrow belt around the southern Caspian Sea and along the Turkmenistan and Afghanistan borders (Sehhatisabet *et al.* 2012), winter numbers (origin uncertain) have recently increased to 57,000, their use of borderland areas plausibly being attributed to hunting restrictions there (Yousefi *et al.* 2017). Wintering birds in Azerbaijan, where low-voltage powerlines are 'a serious danger', prefer large areas of undisturbed semi-desert and steppe under pasture, avoiding intensive agriculture (Gauger 2007).

Little Bustard: overall assessment. Estimates of winter populations in Azerbaijan and Iran (>200,000 birds) are much higher than numbers from breeding areas in European Russia and Central Asia suggest. Kazakhstan held most of the Central Asian breeding population and it appears that today numbers must be larger than the current most optimistic estimates. This is encouraging, but a recent return to intensive agriculture is anticipated to cause declines in the near future (Kamp *et al*. 2011). In addition, poaching on winter grounds, particularly in Azerbaijan, appears to be a serious threat (Iñigo & Barov 2010) that is unlikely to diminish soon, given the cultural importance and poor regulation of hunting in the Caucasus (Conservation International 2003, Yousefi *et al*. 2017).

Great Bustard *Otis tarda tarda*

The race *tarda* occurs disjunctly from Morocco and Iberia to Kazakhstan and north-west China. A detailed analysis of historical and contemporary evidence for Central Asia was provided by Kessler & Smith (2014).

Asian Russia. Historically, Great Bustard bred in northern Asian steppes, forest steppes, river valleys and boreal forest clearings south of 54°N (Menzbir 1895). Declines attributed to hunting were noted before 1900 (Aksakov 1852, Nefedov 2001), and further declines occurred throughout the twentieth century owing to hunting, agricultural intensification and poisoning by agricultural chemicals; numbers were estimated to have fallen from 2,515 in 1971 to 385 by 1980 (Potapov & Flint 1987). The species was listed as USSR Category II—having a relatively high but catastrophically declining population—in 1984 (Ponomareva 1985a). Today, regional red listings suggest that <200 birds remain across the 2,500 km of Asian Russia from the Urals to the Altai Republic (Kessler 2015), and the species is now listed as extinct in Tyumen, Omsk and Novosibirsk administrative regions and 'critically endangered' in Orenburg, Bashkortostan, Chelyabinsk, Altai Krai and Altai Republic (Federal Governmental Budget Office of Russia 2018). The largest residual populations are in Orenburg province (<100 breeding birds), adjacent to Kazakhstan, and Omsk province, with immigrants from Kazakhstan speculated to be re-establishing a breeding nucleus (Gavlyuk & Yudichev 1998, Nefedov 2013a).

Kazakhstan. Historically the species bred on the mesic steppes along the northern border and in the foothills of eastern, south-eastern and southern Kazakhstan (Kessler & Smith 2014). In the mid-twentieth century, large-scale hunting and agricultural intensification were serious threats (Gavrin 1962) and various populations decreased by 60–100% across northern Kazakhstan between 1930–1970 (Ryabov 1982), leaving tiny leks (<10 birds) often isolated by large distances (Debelo *et al*. 1986). The enormous area of suitable habitat and the extreme wariness of the remaining birds hamper surveys, but key extant breeding areas are probably in the three disjunct regions of West Kazakhstan, Kostanay and South Kazakhstan (Kessler & Smith 2014). Great Bustards gather in large flocks at migratory stopovers and on wintering grounds, where they supplement resident breeding populations which have been more regularly and reliably surveyed. In bad winter conditions, flocks reach 100–200 in the Karatau foothills, Almaty region and the Alakol Depression in the south and east (Berezovikov & Levinskii 2012), and wintering birds may total 1,000–1,500 (Sklyarenko 2006, Gubin 2007). Today southern Kazakhstan is the major wintering ground for Central Asian *O. t. tarda* in most years. Given that only small numbers overwinter in Russia and Xinjiang province, China, with a dozen or so in Turkmenistan, the larger winter flocks gathering along the southern border of Kazakhstan almost certainly include individuals breeding in Russia and Xinjiang province, as well as Kazakhstan. Thus, despite the species's national Category I red-listing, with a population estimated to be <100 adults (Mityaev & Yashchenko 2006), a rough estimate of 500–1,000 individuals breeding in Kazakhstan could be claimed by subtracting the estimates of breeding birds from Russia and Xinjiang from the estimated overwintering population.

China. Around 2000 the overall population was estimated at 1,060–1,200 (Jiang 2004). Larger estimates for Xinjiang province of 2,000–3,000 in 1994 and 1,600–2,400 in 2007 (Gao *et al*. 1994, 2007) were accepted by Palacín & Alonso (2008) and Alonso & Palacín (2010), but surveys were carried out only in 2014–2016 (see below). Formerly found in Kashgar, the Turpan Basin and Tien Shan foothills (Chan & Goroshko 1998), by the early 1990s *tarda* only bred near the Kazakhstan border in Ili, Tacheng, Altai, Changji and Hami counties, Xinjiang province (Gao *et al*. 1994). Breeding birds declined by 84% from 119 in 1994 to 19 in 2014–2016, and are now only observed at Tacheng, while recently no wintering birds were found in Qapqal where 120 were seen in 1988 (Wang *et al*. 2018). However, October surveys in Tacheng produced 444 passage birds in 2014, 317 in 2015 and 423 in 2016, indicating populations that apparently breed and winter in unknown areas (MW pers. obs.). Taxa *tarda* and *dybowskii* are both Class I taxa of National Primary Protection Class I (State Forestry Administration of China 1988) and red-listed nationally as 'endangered' (Jiang *et al*. 2016).

Kyrgyzstan. Historically the species bred and overwintered regularly in valleys and steppe at up to 3,000 m (Yanushevich & Tyurin 1959) but it is now listed as 'critically endangered', with no records in the past 30 years (Kasybekov 2006).

Tajikistan. The species bred and wintered regularly in Panj valley and the south-west (Gubin 2007), gathering in greater numbers on migration and in winter (Abdusalyamov 1971), but is now only an irregular non-breeding visitor, listed as 'critically endangered' (Kurbonov & Toshev 2015).

Uzbekistan. Despite a few breeding reports, the species was primarily a passage migrant and occasional winter visitor (Isakov & Vorob'ev 1940, Meklenburtsev 1953). Now listed as 'critically endangered', it is an occasional migrant (Kreitsberg-Mukhina 2009, Martin *et al*. 2014), although harsh weather may drive birds wintering in South Kazakhstan to Lake Aidar in the north (Kreitsberg-Mukhina 2003).

Turkmenistan. This was once the most important wintering area in Central Asia, with 'enormous' flocks in the lower Atrek River and northern Kopet Dag foothills, although flocks also passed south to Iran (Isakov & Vorob'ev 1940, Rustamov 1954). Declines were first noted near Ashgabat (Dement'ev 1952) and by 1978 the species was close to extinction nationwide (Ataev *et al.* 1978), with small numbers occurring sporadically in the mid-1980s (Saparmuradov 2003). It is now listed as 'critically endangered', with some dozen birds wintering in the Kopet Dag foothills (Saparmuradov 2011).

Extralimital. Until 1976, birds from Asia regularly wintered in the southern Kopet Dag foothills, north-east Iran (Zarudnyi 1903, Cornwallis 1983), but were not noted after 1976, apart from one bird in 2008 (Rabiee & Moghaddas 2008, Barati *et al*. 2015).

Great Bustard *O. t. tarda*: overall assessment. Population trends (and threats) are similar across Central Asia, reaching a low in 2000, with a slight increase since, probably due to better reproduction after the post-Soviet agricultural collapse (Kurganova *et al.* 2013).

However, abandoned farmland is now being reclaimed and pesticide use rising (Kamp *et al*. 2011), and any natural population increases are probably nullified by heavy poaching.

There are few breeding surveys (but see Kessler & Smith 2014), and most birds now usually winter in southern Kazakhstan, so the estimate of 1,000–1,500 birds wintering in Kazakhstan (Sklyarenko 2006) is a plausible total for Central Asia and west China, although the data are 10 years old and urgently need updating. Apart from poaching, notably by elites unaccountable to law, adult birds are lost to powerlines and dogs; eggs and chicks are lost to harvest machinery, wildfires and flooding by irrigation; and chicks suffer food depletion as a result of pesticides used during locust outbreaks (Kel'berg & Smirnov 1988, Chan & Goroshko 1998, Nefedov 2013b).

Great Bustard *Otis tarda dybowskii*

This race, disjunct from *O. t. tarda*, breeds in Mongolia, south-east Russia and north-east China, wintering almost entirely in China (AEK pers. obs.); a full review of sources and known localities in east Asian Russia, Mongolia and China up to 2000 is in BirdLife International (2001), while Goroshko (2002, 2008) and Kessler *et al*. (2013) respectively provided new insights into the ecology and migration of *dybowskii*. Chan & Goroshko (1998) estimated the global population at 1,200–1,500, amended first to 1,200–1,700 (Goroshko 2000) and then to 1,500–2,200 (Alonso & Palacín 2010). Population genetics indicated a population of 1,456–2,187 birds, but also a long-term decline (Liu *et al*. 2017).

Asian Russia. Almost entirely migratory, although wintering areas are still very poorly known, *dybowskii* bred widely in steppes, forest steppes and lake and river basins in eastern Russia, with a 1940s population estimate of 50,000 which 50 years later had fallen to 800 (Chan & Goroshko 1998) or even 530–650 (Goroshko 2000). In other assessments, the Russian population had crashed by 1971 to 1,650 and by 1980 to 440 (Potapov & Flint 1987) or 300, of which 50 were in the Minusinsk and Tuva steppe and 250 in 'Trans-Baikal-Amur' (Isakov 1982, Collar 1985). This disaster has been attributed to year-round hunting, agricultural intensification (widespread ploughing of steppes in the 1960s), pesticides, anthropogenic springtime steppe fires and unnaturally high crow, fox and dog predation (Chan & Goroshko 1998, BirdLife International 2001). Today, *dybowskii* is probably extinct in Khakassia and Irkutskaya regions, 'critically endangered' in Amurskaya, Primorskii, Tuva and Zabaikal'skii, 'near-threatened' in Buryatia and vagrant in Krasnoyarskii (Federal Governmental Budget Office of Russia 2018); it has not been seen since the 1990s in Primorskii (Nechaev 2005), Amurskaya (Goroshko & Andronov 2009), Irkutskaya (Popov & Medvedev 2010), Khakassia or Krasnoyarskii (Savchenko *et al.* 2012). Southern Zabaikal'skii Krai supported 350–450 birds in 2010 but holds only 250–300 today, concentrated in Torey and Urulyunguy basins in the south-east and Onon River basin in the south-west (Goroshko 2012). Only about 5% of these populations—contiguous with populations in Khentii and Dornod provinces, Mongolia—are in protected areas (OAG pers. obs.), and are reported to fluctuate with 30-year precipitation cycles (Goroshko 2003). Buryatia retains about 100 birds in the south-east and in Tunguiskii Reserve, contiguous with a small population in Selenge province, Mongolia (Elaev 2013). About 30 birds remain in Tuva, contiguous with a small population in Uvs province, Mongolia (Archimaeva *et al.* 2015). In total, only 380–430 individuals probably survive in Asian Russia today.

Mongolia. Less than 100 years ago *dybowskii* bred commonly across forest steppe, steppe, dry steppe zones and farmland in the north, with most migrating south to winter (Andrews 1921, Bannikov & Skalon 1948, BirdLife International 2001). In the 1980s a 'shocking decline' dating back over 50 years was reported (BirdLife International 2001). In the early 1900s, increased hunting, facilitated by improved weaponry and motorised access, coupled with the closure of Buddhist monasteries, was compounded by unintentional poisoning with rodenticides (Bold 2003, Tseveenmyadag 2003). In 1926 hunting the species was banned in the breeding season and in 1979 it was banned altogether (Bold 2003), but rapid declines and local extirpations continued in Töv, Selenge, Arkhangai and Uvs provinces, with birds persisting only in the remote north and east (Batsaikhan 2002, Tseveenmyadag & Bold 2005, Boldbaatar 2006). The spread of mechanised cereal farming using chemical inputs (Erdenee 2011) across important breeding grounds—the area under cultivation increased by 166% between 1960 and 1990—almost certainly reduced productivity (AEK pers. obs.). In 2003 the national population was estimated to be 1,500–1,700 (Tseveenmyadag 2003) but heavy livestock grazing reduced cover for nesting birds (BirdLife Asia 2009) and in 2011, with <1,000 mature adults remaining and declines ongoing, *dybowskii* was nationally listed 'vulnerable' (Gombobaatar & Monks 2011). Today breeding populations remain in Nomrog, Mongol Daguur, Khurkh and Onon River valleys, and south-east Hövsgöl and adjacent Bulgan province, with smaller numbers in Orkhon River valley and Uvs Lake basin; all except Hövsgöl are contiguous with populations in Russia and Inner Mongolia, China (Tseveenmyadag 2001). Breeding was unsuccessful among a group of tagged female birds in the Hövsgöl/Bulgan population, owing to poor weather, corvid predation and nest destruction by agricultural machinery; many other populations in wheat-farming areas suffer nest and chick losses during harvest (Batsaikhan 2002, Kessler 2015). The tagged females made several unpredictable and unrepeated stopovers over four months before wintering in agricultural fields near Weinan, Shaanxi province, China (Kessler *et al.* 2013, Dashnyam *et al.* 2014, Kessler 2015).

China. Great Bustards race *dybowskii* bred (and may still breed) in the north-east from the Mongolian border at Hulun Buir and Xilin Gol, Inner Mongolia, east to Lake Khanka; most birds migrated south and in winter they were replaced by large flocks (as many as 600 birds) which had bred further north (BirdLife International 2001). Hunting, habitat conversion and pesticide use are blamed for massive declines during the twentieth century (Chan & Goroshko 1998). The first national terrestrial wildlife surveys (1999–2002) estimated that 618–625 birds remained (Jiang 2004), in three discrete breeding areas—Songnan, Horqin and Hulun Buir steppes, north-east China (Chan & Goroshko 1998, BirdLife International 2001). Since then breeding sites have contracted in area and populations probably decreased (GL pers. obs.). Winter sites also contracted in the late 1900s and birds became rarer, particularly in the Yellow River delta, Shandong province, and the lower Yangtze River (Wang 2012). At some stage birds began wintering on Songnan steppe breeding sites (numbers put at 135 in 1999–2002), and in 2003 165 were at Tumuji Nature Reserve, north-east Inner Mongolia (Li *et al.* 2005); breeding/wintering populations there were 158/58 in 2013, 98/45 in 2014 and 109/69 in 2015 (GL pers. obs.). Today the most important winter sites are Cangzhou, Hebei province, Weinan and Hancheng, Shaanxi province, and Songnan steppe, Inner Mongolia and Jilin province (Liu *et al.* 2017), but birds also winter at Jinzhou, Liaoning province, and along the Yellow River, Henan province (GL pers. obs.). Bayan Nur, Inner Mongolia, Hebei province and Beijing are important migration stopovers, although many casualties are reported: 70 injured birds in Hebei province between 2007–2011 (Wu *et al.* 2011) and nine in Beijing between 2006–2009 (Gao *et al.* 2009). The Great Bustard was categorised nationally 'vulnerable' in 2009, with 20% declines anticipated over the next decade (Ding & He 2009), and was subsequently designated 'endangered' on the basis of its small range, <2,500 mature individuals and projected declines

(Jiang *et al*. 2016). Habitat degradation mainly due to agricultural intensification, poisoning by pesticides used to protect sprouting wheat, and hunting, including for traditional medicine and food at mostly unprotected wintering sites, are ongoing threats (Lin 2016, Mi *et al*. 2016, Liu *et al*. 2018, GL pers. obs.), while powerline collisions (e.g. Liu *et al*. 2013) are judged a major threat (Cheng *et al*. 2011); deaths on metal fences have also recently been recorded (YZ pers. obs.).

Korean Peninsula. Once a common winter visitor (27 localities mapped) but rarely reported since 1980 (BirdLife International 2001).

Great Bustard *O. t. dybowskii*: overall assessment. Today, the estimated breeding population is about 2,000 birds (Russia 380–430, Mongolia 1,000, China 600), roughly matching the upper limit (2,187) determined in a recent genetic study (Liu *et al*. 2017). However, most breeding sites are near international borders, so estimates may include some double-counts. Comprehensive surveys are needed at all breeding and wintering sites. Poaching (including poisoning) and collisions with powerlines must be addressed across the entire range, and agricultural practices on breeding grounds need modification. Climate change is predicted to bring new challenges as desiccation reduces habitat carrying capacity (OAG pers. obs.) and as agricultural schedules and migratory and wintering patterns shift (Kessler 2015, Mi *et al*. 2016). The prognosis is thus very poor: the populations are too scattered to reinforce one another (Allee effects), the threats many, and logistics and costs of management clearly considerable.

Asian Houbara *Chlamydotis macqueenii*

Collar (1980), Goriup (1997) and Allinson (2014) provided status reviews, with stepwise improvements in evidence. Resident populations from Sinai, Egypt, north-east to Iraq are very small, with Iran estimated to hold 1,000–3,000 birds (Allinson 2014). Goriup (1997) estimated 37,000–50,000 birds in Asia (as defined here), whilst Allinson (2014) estimated 74,030–86,340 although conceding that, owing to high uncertainty, a safer range was 50,000–100,000; nonetheless, whatever the numbers, the overall trend is downwards.

China. The species was not discovered in China until the 1980s, presumably due to the remoteness of desert areas in the country. A 1994 survey of 14,900 km^2 in northern Xinjiang province (Gao *et al*. 1994) estimated a population of 280–525 birds, from which Goriup (1997) derived a national population of >500. Subsequent fieldwork found a discontinuous population, estimated at 2,000 birds, breeding from the Gobi Desert west to the Junggar Basin (Combreau *et al*. 2002, Yang *et al*. 2003, Gao *et al*. 2008). However, further analysis of data collected in the early 2000s suggests that 6,000–8,000 birds were present in the Junggar Basin alone at that time (Allinson 2014), with breeding in the west (Ganjiahu, Karamay district), north (Fuhai, Ulungu River valley), south (near Borohoro Shan) and east (Kalamaili Nature Reserve and up to Jiangjun Gobi, Mori region) of the basin, the centre of which remains poorly explored (Judas *et al*. 2005, OC pers. obs.). In Xinjiang province breeding was confirmed in the southern Turpan Basin and Ba Li Kun region and in the Chinese Gobi, with a disjunct population in Ejinaqi and Alashanyouqi regions, western Inner Mongolia, and Wuwei, Shandan and Minqin, Gansu province (Judas *et al*. 2005, OC pers. obs.). Satellite telemetry confirmed that passage migrants from the Gobi regularly stop in the steppe and gravel plains north of the Tarim Basin near the Tien Shan foothills; surveys are needed to establish whether birds breed there (Judas *et al*. 2006, OC pers. obs.). Surveys in the Junggar Basin revealed steep declines in relative abundance and density in 1998–2002 (Tourenq *et al*. 2005), probably accelerated by extensive mining, oil exploration and large-scale agricultural activities in the steppe (http://www.chinadaily.com.cn/china/2017-12/01/content_35155996.htm; https://www.chinadialogue.net/article/show/single/en/8950-China-s-mining-industry-damages-wildlife-paradise-). Today the species is listed as nationally 'endangered' (Jiang *et al*. 2016).

Mongolia. Collar (1980) omitted this range state, although the species was noted in the breeding season in the southern Gobi Desert (Andrews 1932), where today it is listed as a rare breeding bird (Purevsuren *et al*. 2013). Bannikov & Skalon (1948) described it as widely distributed in western Mongolia, and Batsaikhan *et al*. (2005) confirmed breeding between the northern border and the Altai Mountains, including the Great Lakes Depression, Uvs Nuur Basin and Khar Us Nuur area. South of the Altai, small numbers are reported regularly in the Junggar Gobi, and it breeds in good densities south of the Khangayn Nuruu, north and south of the Gobi Altai and east to Galba Gobi (107°E) (Batbayar *et al*. 2011, OC pers. obs.); further east is unexplored, but herders near Dalanzadgad reported seeing birds as far east as 111°E (OC pers. obs.). It is now regarded as an uncommon breeding visitor to a wide area of the western and southern borders (Tourenq *et al*. 2004a, Batbayar *et al*. 2011). An estimated national total of <300 birds (Gombobaatar & Monks 2011) has been revised to a possible 2,000 (Allinson 2014). An apparent 'decline in recent years' (Goriup 1997) is the only comment on population trends, but habitat is being destroyed by widespread mining and unregulated off-road activities (Batbayar *et al*. 2011), while collisions with powerlines have been reported (Dashnyam *et al*. 2016).

Asian Russia. Historical records compiled by AAN from east Orenburg province, Omsk and Altai Krai indicate occasional breeding, but mostly passage movements; small numbers breed in the Kurai and Chui steppes, Altai Republic (Mitrofanov 2007).

Kazakhstan. The species's breeding stronghold is in the south, which in spring and autumn is also visited by passage birds breeding further east. Even so, Collar (1980) cited a 1962 report of noticeable declines due to uncontrolled shooting from motor vehicles and a 'sharp decline' indicated in the 1978 Soviet Red Data Book, as well as personal accounts of extremely low numbers over vast areas. Gubin (1992) reported a sharp and ongoing decline 'following intensive development of the desert', but suggested that the 'main limiting factor' was 'persecution by people', particularly herdsmen. Although data which Gubin (2008) provided from 2001–2005 surveys are uninterpretable, a total of 38,325 is compatible with his later assertion that 'Kazakhstan holds approximately 30–40 thousands houbara' (see also Goriup 1997). Analysis of data for 1998–2002 from biannual surveys of the five main populations in southern Kazakhstan suggested serious declines (Tourenq *et al*. 2004b, 2005). Results from 2000–2009 were marginally better, with two populations stabilising and even increasing, possibly as a consequence of the military campaign 'Operation Enduring Freedom' in Afghanistan. Even so, the overall population declined by either 36% or—if an anomalously steep fall in the Kyzylkum Desert in 2000–2001 is omitted—26% (Riou *et al*. 2011).

Uzbekistan. Much of the western two-thirds of the country consists of semi-desert (Kyzylkum Desert, Ustyurt Plateau) and is used by large numbers of migrating Asian Houbara and a smaller but significant breeding population. In the north-west Kyzylkum, numbers fell by 75% between 1956 and 1979, with 'a particularly noticeable decline... since 1970', attributed to artesian wells extending grazing capacity, new roads and hunting (Alekseev 1985). In the southern Kyzylkum the decline was attributed to agricultural intensification and expansion, increased disturbance, local poaching and 'large-scale hunting on wintering grounds' (Ponomareva

1985b). Goriup (1997), citing an unpublished report suggesting 2,200–2,700 breeding females in the country, extrapolated a national total of 6,000–9,000 birds; Allinson (2014) speculated that 10% of this estimate overwinter. Recent surveys in 14,300 km^2 of south-east Kyzylkum produced an initial estimate of 1,824 (1,645–2,030) breeding males (Koshkin *et al.* 2016a), suggesting roughly 4,000 breeding birds (Burnside *et al.* 2015) in a relatively small part of the available habitat; further refinement of survey data indicates 2,350 breeding females in the study area (Dolman *et al.* submitted). The species is common in an adjacent similar-sized area of the Karnabchul steppe (Martin *et al.* 2014). Nevertheless, demographic modelling based on field parameters suggests that the population is declining at 9.4% a year, owing to unsustainable winter mortality (Dolman *et al.* submitted).

Turkmenistan. The Karakum Desert covers 70% of the country and is a spring and autumn stopover for the entire migratory Asian Houbara population breeding to the north and east (Allinson 2014); where there is scrub vegetation it also appears to provide suitable habitat for a significant breeding population. However, no surveys have been undertaken (and no hunting has seemingly been allowed); the published figure of >500 breeding birds (Goriup 1997) is evidently unsubstantiated, and winter numbers of 3,500–4,500 have been suggested (Allinson 2014).

Afghanistan. Sparse evidence was precautionarily taken to indicate the scarcity of the species in this ornithologically little-known country (Collar 1980), but satellite telemetry (Combreau *et al.* 2001, 2011, Riou *et al.* 2012) has revealed that the western plains appear to serve as a funnel for many thousands of birds and as winter quarters for 16,500–19,200 of them (Allinson 2014), mainly in the south-west, and probably as an extension of resident populations in Iran. Satellite-tagged birds staying all summer in the north possibly breed there (Allinson 2014). Arab falconers have long known of the species in the country (Colls 2004), but the scale of hunting is unknown.

Pakistan. A small resident population exists (or existed) in Balochistan province (Shams 1985, Roberts 1991); eggs gathered there in 1986–1988 produced the captive stock that was used for reintroduction efforts in Saudi Arabia (Saint Jalme & van Heezik 1996), although a decade later <100 wild birds were speculated to remain (Goriup 1997). Winter hunting by Arab dignitaries started around 1966 and a downturn is consistently reported to have occurred soon afterwards. In 1971 it was claimed that 'numbers have declined dramatically in recent years in Pakistan' (Collar 1980). In Sindh province 'a clear reduction... became severe after 1970' as a result of 'great pressure from... Arab falconers', who killed at least 1,500 birds in winter 1981–1982 (Surahio 1985). Between 1971 and 1985 falconry caused a 30% fall in numbers wintering in Cholistan, bordering India's Thar Desert (Mirza 1985). In Balochistan a marked decline since 1968–1973 was attributed to overhunting plus increasing disturbance, habitat loss and decreasing rainfall (Mian & Dasti 1985). Estimated hunting offtake there was 5,000–6,500 (20–25% by local hunters) in winter 1982–1983 (Mian & Dasti 1985), 3,961* (leading to an estimated total of 5,000) in 1983–1984 (Mian 1988) and 4,955* in 1984–1985 (Mian 1986) (*these numbers compiled from questionnaire responses). Total numbers wintering in Balochistan were estimated at 20,000–25,000 (Mian 1986) and 19,000 (Goriup 1997), and in Punjab 4,854–6,268 in 1999 (Nadeem *et al.* 2005) and 4,746–6,085 (based on surveys in three areas) in November 2001 (Nadeem *et al.* 2004). Allinson (2014) estimated that 23,000–27,000 birds winter in Pakistan, but these numbers were based on necessarily crude assumptions about breeding populations and their winter distributions. The effect of captive-bred birds released in Pakistan and Central Asia on numbers is unknown and, with no data from breeding facilities, cannot be calculated. Likewise, numbers killed annually by falconers are unrecorded and a matter of speculation, although individual reports inflame a recurrent conflict between the government, the Supreme Court and regional high courts about the granting of permits to foreign falconers to hunt quotas that are, in any case, never observed (Anon. 2015a, Khan 2016a, Khan 2016b, Orubah 2016).

India. Birds wintering in Rajasthan and Gujarat breed mainly in Mongolia and eastern Kazakhstan (Combreau *et al.* 2011). The prime winter sites in Gujarat are: Lakhpat, Abdasa, Bhuj and Bhachau *talukas*, Surendranagar, and the Bhal area of Bhavnagar and Jamnagar districts (YVJ, SD pers. obs.), and in Rajasthan: Jaisalmer, Jodhpur, Bikaner and Churu districts (Islam & Rahmani 2011). Hunting by Arab falconers occurred from 1974 until 1980, when it was banned. Subsequent population declines in Rajasthan were attributed to overgrazing (Rahmani & Soni 1997); in Gujarat livestock numbers increased by 38% from 1997 to 2012 whilst rampant *Prosopis juliflora* invasion has degraded grasslands in Saurashtra and Kutch (DG, KG pers. obs.). Wind turbines, solar farms and powerlines are widespread in the Greater Rann of Kutch, where most sightings are in or near Banni and Naliya grasslands (GAJ pers. obs.). Goriup (1997) estimated 2,000–5,000 wintering birds and Allinson (2014) estimated 3,000–3,500, but the evidence for either is tenuous. Threats are very similar to those faced by Great Indian Bustard and Lesser Florican.

Extralimital. Wintering birds (October–April) were once 'very plentiful' along the west side of the Arabian Gulf from Kuwait to Bahrain, with 'many thousands' hunted (2,000 each in Kuwait, Saudi Arabia and Bahrain) at least up to the mid-twentieth century (Collar 1980). More recently, the failure of all 103 satellite-tagged birds to reach the Arabian Peninsula to winter was attributed to 'decades of unregulated off-take and severe habitat degradation in this area' (Combreau *et al.* 2011). In Iran, where populations include migratory birds, a 1970 source indicated that the species had 'seriously declined' and another in 1975 described it as 'steadily declining' (Collar 1980). Elsewhere in the Middle East resident populations have severely decreased in extent and numbers, and migrants now rarely visit (Collar 1980, Goriup 1997, Allinson 2014, Burnside *et al.* 2017).

Asian Houbara: overall assessment. Anecdotal and quantitative evidence points to a significant ongoing decline from a condition of considerable abundance a century ago. The IUCN category Vulnerable was assigned based on the acceptance of the lower decline rate provided by Riou *et al.* (2011) in what was considered a 'cautious' move (Allinson 2014), although a precautionary position would have accepted the higher decline rate and categorised the species as Endangered.

It is abundantly clear that hunting by Arab falconers and local poachers continues unabated, but it is entirely unclear whether the mass-production of captive-bred birds—the only serious conservation measure being implemented—is helping stabilise numbers, masking the need to arrest the decline by other means, or even, by compromising the quality and security of local breeding stock, accelerating the collapse of wild populations to the point where they may never recover. A very rough population estimate of 50,000–100,000 birds (Allinson 2014) should not reduce the urgency of the need for remedial action.

Great Indian Bustard *Ardeotis nigriceps*

A complete review to the year 2000 (BirdLife International 2001) resulted in the species being classified as Endangered; it was raised to Critically Endangered in 2011 (BirdLife International 2017). Important updates appeared in Dutta *et al.* (2011) and Rahmani (2012).

India. Populations of low-density, wide-ranging and reclusive species are always hard to assess, but the decline in range and numbers of Great Indian Bustard has continued for over 100 years (BirdLife International 2001). Estimates of 1,000–2,000 birds remaining in the 1980s and of 600–700 by 2000 (Rahmani 2012) have not been disputed. By 2010, the estimate had shrunk to 300, fragmented into eight small discontinuous groups (Dutta *et al*. 2011). By 2014 the estimate declined to 200, with the only potentially recoverable populations located in the Thar Desert, Rajasthan, which held 155±94 in 2014 and 166±74 in 2016 (Dutta *et al*. 2014, 2016) and now holds 140±53 (SD pers. obs.), with 50% of the population in army-controlled grasslands near Pokhran that are relatively free of consumptive human uses but are used for artillery testing (YVJ, SD pers. obs.). In Gujarat, numbers were given as 40 (Collar *et al*. 2015, Narwade *et al*. 2015a), with a 'decline from 48 in 2007 to 25 in 2016' *fide* Forest Department, Government of Gujarat (DG, KG pers. obs.), although today there are probably <20 (SD pers. obs.). Only 10–20 birds survive in the vast Deccan plateau covering Maharashtra, south-central Andhra Pradesh and northern Karnataka (Narwade *et al*. 2015a, 2017, SSN pers. obs.), whilst in Madhya Pradesh there have been no recent sightings (SSN pers. obs.).

The greatest present threat faced by the species is fatal collision with overhead power transmission/distribution lines. Powerlines have multiplied across the species's open habitats and collisions have caused at least nine fatalities in the past decade, including four in 2017 (Dutta 2018). In Gujarat a large power substation is planned in the species's breeding and wintering area near Kunathia village, Kutch district (DG, KG pers. obs.). In Rajasthan, several wind turbines have been installed (albeit currently targeted for mitigation) in prime habitat between Salkha and Mokhla villages, Jaisalmer district (SD pers. obs.). Nest predation by feral dogs and pigs is suspected to be reducing productivity (Rao & Javed 2005, Dutta *et al*. 2013). Agricultural expansion and intensification, involving mechanisation, year-round harvesting, reduced fallow periods, increasing use of pesticides, fertilisers and inappropriate crops, have depleted resources, destroyed habitat and increased disturbance. Livestock numbers doubled to 500 million in half a century even as the area of pasture halved, resulting in significant overgrazing of bustard habitat (GSB, YVJ, SD pers. obs.). Invasion of grasslands by introduced mesquite *Prosopis juliflora* and conversion of grasslands to shrub/tree plantations have rendered former bustard habitats unsuitable (Dutta *et al*. 2013). Other threats include increasing disturbance by cattle, dogs and humans (including unethical photographers) and (in some places) outright local hostility owing to legal restrictions on land-use and burgeoning populations of legally protected Blackbuck *Antilope cervicapra*, which cause crop damage in adjacent farmlands (Manakadan & Rahmani 1998, Rao & Javed 2005, Dutta *et al*. 2013, Narwade *et al*. 2015a). The political issue of treating grasslands as 'wasteland' by India's Revenue Department compounds the problems (see pages 9–10).

Pakistan. Records are from Sindh province (six locations) and the Punjab (three locations), with nesting confirmed (BirdLife International 2001). Hunting has been a serious issue: of 63 birds reported crossing into Cholistan from Rajasthan in June–September in 2001–2004, 49 were killed/trapped, mainly by local residents, 20 in 2001, 14 in 2002, 8 in 2003 and 7 in 2004, with individuals fetching about US$150 in local markets (Khan *et al*. 2008).

Great Indian Bustard: overall assessment. The eight Great Indian Bustard sanctuaries created in India after the 1980 international symposium (Goriup & Vardhan 1983) were compromised by delays in land-rights settlements with consequent lack of local support, lack of good grassland management, poor coordination and inadequate funding (GSB pers. obs.). Unfortunately, some sanctuaries were too small to accommodate the annual needs of the species while others were unnecessarily large, generating public antagonism due to legislative restrictions on land-use and transactions (YVJ, SD pers. obs.), and land-use around them was not regulated, reducing their viability and effectiveness (Dutta *et al*. 2011).

Only around 170±63 adults remain; individual populations are too small and fragmented, and efforts to restore habitat are too small-scale; the proliferation of powerlines in areas where the species survives renders the situation increasingly dangerous (Dutta 2018, GSB pers. obs.).

Bengal Florican *Houbaropsis bengalensis*

A review of evidence up to 2000 (BirdLife International 2001) categorised the species as Endangered; it was raised to Critically Endangered in 2007 in response to negative trends in Cambodia (BirdLife International 2017). Important updates appeared in Rahmani (2012), Donald *et al*. (2013) and Inskipp *et al*. (2016).

India. Conversion of floodplain and alluvial grasslands to agriculture has left sites, even those inside protected areas, where Bengal Florican survive 'small and isolated, making the populations susceptible to local extinctions' (Dutta *et al*. 2013). Such local extinctions, attributable to natural succession and human encroachment and disturbance owing to poor infrastructure and training of staff (Dutta *et al*. 2013), have occurred in Katerniaghat Wildlife Sanctuary, Uttar Pradesh, where the species was last seen in 2001 (Sivakumar *et al*. 2014), despite an intensive search in 2016 (RRSJ pers. obs.); Kishanpur Wildlife Sanctuary, Uttar Pradesh, where the last sighting was of two territorial males in 2013, despite intensive surveys in 2014–2017 (RRSJ pers. obs.); Bornadi Wildlife Sanctuary, Assam, with grasslands badly degraded by woody invasives and no birds seen by staff since 2000; Sonai-Rupai Wildlife Sanctuary, Assam, with no birds seen since 2000; and Nameri National Park, Assam, also with no birds seen since 2000 (Brahma & Lahkar 2009, Rahmani 2012, BPL pers. obs.). Field surveys of protected and unprotected areas throughout the known remnant Indian range during 2013–2017 yielded sightings of 137–140 territorial males and 18 females, with the adult territorial male population estimated to be 174–198 (Rahmani *et al*. 2016, 2017, RRSJ pers. obs.). Assuming an unbiased adult sex ratio—possibly not reliable because females are commonly less numerous in small declining populations (Donald 2007)—there may be no more than 350–400 adult birds in India, mostly in Assam's protected areas and Brahmaputra River *chaporis* (islands), although the Daying Ering (D'Ering) Memorial Sanctuary, Arunachal Pradesh, and its immediate environs probably hold the single largest South Asian population, with 50–60 adult males (Rahmani 2016). Even so, in the 1990s and early 2000s birds were opportunistically poached from tractors and jeeps in D'Ering and Manas reserves (AUC pers. obs.), and the problem persists at both sites (GAJ pers. obs.). Dam construction on tributaries of the Brahmaputra may adversely affect some key sites by changing the flood regimes (HSB, SD pers. obs). The situation is most alarming in Uttar Pradesh's reserves where, for example, in Dudhwa Tiger Reserve 17 adult males were counted in 2001 (Kumar 2013) but only seven could be found 15 years later (Rahmani *et al*. 2017).

Nepal. Only seven males and four females were found in Chitwan National Park in 2012, a decline attributed to 'habitat... being gradually encroached through the invasion of alien species, scrub expansion and the succession of tall grass species and trees' and 'an increase of illegal grass cutting during the florican's breeding season' (Khadka *et al*. 2013). However, grasslands in and around Koshi Tappu Wildlife Reserve, partly protected by natural river formations, held a moderately healthy population, with 47 birds (29 males, 18 females) counted (up to 60 estimated) after cattle numbers in the reserve were 'drastically reduced', resulting in regenerating grasslands (Baral *et al.* 2012, 2013). A repeat survey in April 2017, with slightly greater coverage, yielded 43 birds (29 territorial males, 2 non-territorial males, 12 females), but grassland on two unprotected islands had been degraded, with less than half the number of birds seen in 2012 (Baral *et al.* in prep.). Overall, <100 adult birds (of 57 birds counted, 40 were males, 17 females) may survive in or near the four protected areas of Shuklaphanta, Bardia, Chitwan and Koshi Tappu (DNPWC 2016).

Recent telemetry studies in India and Nepal indicate that birds disperse from grassland reserves annually during the flood season, probably because the grass grows too tall and dense. All three fatalities among 11 satellite-tagged birds occurred between mid-August and mid-September when birds left protected breeding areas for adjacent degraded grassland and farmland near human settlements (DNPWC 2016, Jha *et al.* 2018), suggesting that they were victims of hunting or predation. It seems likely that important areas on the Koshi River will be unfavourably affected when dams alter flood regimes (HSB pers. obs).

Cambodia. In 1999, grasslands of the Tonle Sap floodplain were estimated to hold 1,000 Bengal Florican, with as many as 300–600 birds being traded annually as food (Donald *et al.* 2013). However, land-use change was already supplanting persecution as the main threat. Grassland cover around the Tonle Sap declined from 3,349 km² in 1995 to 1,817 km² in 2005, a net loss of 46%, whilst in the important south-east of the floodplain grassland declined from 923 km² in 2005 to 751 km² in 2009—19% in four years (Packman *et al.* 2013). Extrapolation from a 28% loss of grassland cover in research plots between January 2005 and March 2007 produced an estimated floodplain-wide decline in male birds from 416 to 294 (Gray *et al.* 2009a). Although somewhat revised in a later analysis, the trend did not change: a 43% decline in the estimated number of displaying males, from 293–462 (mean 377) in 2005–2007 to 156–275 (mean 216) in 2012 (Packman *et al.* 2014); worryingly, a preliminary survey in 2017 yielded just 135 displaying males (SPM pers. obs.). Very little suitable grassland now remains outside protected areas which, although small, support >50 displaying males, most in Stoung-Chikreang Bengal Florican Conservation Area. Outside the protected areas about 100 displaying males are spread across 8–10 sites, where they use fallow or abandoned ricefields and grassland fragments (WCS unpubl. data). Increasing irrigation has reduced such areas in the early breeding season by allowing double cropping of rice (Ibbett *et al.* 2017). Breeding season home ranges of 12 satellite-tagged males in the Tonle Sap grasslands averaged 31.3 km² (robust estimate of total range), with birds most likely to be found in a 2.6 km² core area, whereas ranges of nine satellite-tagged females averaged 42.8 km² with a 4.7 km² core range; smaller ranges contained a greater percentage of grassland, suggesting that range size expands with habitat fragmentation (Packman 2011). Both sexes avoided agricultural areas but showed strong fidelity to breeding sites, even after habitat conversion, raising concern that the species's adaptive capacity may be low (Packman 2011). Predation of eggs, chicks and nesting females by dogs is a potentially serious unquantified threat in all areas (SPM pers. obs.). Satellite-tracking shows that outside the breeding season, when the Tonle Sap is in flood, birds move short distances into surrounding areas (Packman 2011), preferring (a) medium-canopy forest and open savannah to agriculture or closed-canopy forest, and (b) grass cover (especially) and fallows to bare ground and plantations (Hillard 2012). However, these preferred winter habitats are rapidly being converted to cassava (Hillard 2012), with only one area protected (WCS unpubl. data). Adult survival is high (89%), but powerlines currently under construction will cross almost all breeding and non-breeding areas, with predictably catastrophic consequences (SPM pers. obs.).

Vietnam. The species has been recorded at four localities in the south, including Tram Chim Nature Reserve (BirdLife International 2001), but 'such was the speed and intensity of agricultural development, which took with it most of the small (76 km²) Tram Chim reserve, that hopes for the species' continued survival in that country have faded and attempts to conserve it stalled' (Donald *et al.* 2013).

Bengal Florican: overall assessment. Range maps in BirdLife International (2001) indicate that the species lost about 75% of its South Asia range during the previous 150 years, particularly after control of malarial mosquitoes in the 1950s and 1960s, which 'precipitated the descent into the region of settlers who immediately dispossessed the sparse malaria-resistant indigenous population and began ploughing and planting up the grasslands' (Donald *et al.* 2013). Even the few reserves where terai vegetation persists hold only small areas of Bengal Florican habitat, and bird numbers are small and mostly declining—in Nepal's three major grassland parks, Shuklaphanta, Bardia and Chitwan, male numbers fell from 29–41 in 1982 to 14–15 in 2007 (Donald *et al.* 2013). In South Asia overall, surveys in various areas suggest a significant decline, with 298–396 birds recorded in the period 1996–2007 falling to 179–182 in 2013–2017.

In Indochina the species is almost entirely restricted to the Tonle Sap floodplain, where rapid agricultural intensification continues to drive a steep decline; remaining populations are small and, with one exception, declining (WCS unpubl. data), and all are at risk from powerline development. The situation is clearly very serious, but evidence from Koshi Tappu, Nepal, indicates that the species is capable of rapid colonisation of good habitat, so there are ongoing opportunities for recovery through appropriate management of the many reserves where the species survives.

Lesser Florican *Sypheotides indica*

A complete review of sources up to 2000 was given in BirdLife International (2001), when the species was categorised as Endangered (as it currently remains); an important update appeared in Rahmani (2012).

India. The species breeds in fragmented agro-grasslands across Rajasthan, Gujarat, Madhya Pradesh, Maharashtra and Andhra Pradesh (Dutta *et al.* 2013). Population assessments are based on males (females are very hard to detect); breeding distribution depends on local rainfall, with males moving to areas with higher precipitation and abandoning display during droughts (Dutta 2012), making population trends hard to monitor, but all reports indicate declines in both numbers and distribution. During an August 2010 survey of Rajasthan, Gujarat and Madhya Pradesh, only 83 displaying males were found in 24 agro-grassland areas, compared with 238 in 37 agro-grassland areas in 1999 (Bhardwaj *et al.* 2011), albeit sampling methodology was different. In July–September 2017 a systematic range-wide survey by several national agencies employing advanced population sampling and estimation methods counted 60 males and produced a conservative estimate of about 270 males throughout the breeding range (Dutta *et al.* 2018), compared with estimates of 1,103–1,765 males during 1994–1999 (Sankaran 2000), indicating a 75–85% decline over the period.

The current breeding population is largely restricted to the agro-grasslands of Bhinai, Shokaliya and Malpura, Ajmer district, Rajasthan, and the grasslands of Velavadar Blackbuck National Park, Bhavnagar district, and Abdasa, Kutch district, Gujarat; a few individuals were recorded in fragmented pockets of Jalore, Shahpura and Pratapgarh districts, Rajasthan, but none was detected in Madhya Pradesh or Maharashtra (Dutta *et al.* 2018). Although surveys were not fully consistent in methodology, and erratic rainfall (SD pers. obs.) and drought (BirdLife International 2017) may have biased results, the fall in the minimum number of males from 238 (1999) to 83 (2010) and 60 (2017), and the disappearance of birds from known breeding sites (Bhardwaj *et al.* 2011, Dutta *et al.* 2018), provide incontestable evidence of an ongoing population collapse. The species has disappeared from Hathab, Trapaj, Malankun, Gadhada and Sathra, Bhavnagar district, in the past 30 years and from Jamnagar district, Gujarat, in the past 10 years (I. R. Gadhvi, M. Varu, A. Trivedi, Y. Bhatia pers. comm.), while numbers have dwindled in Rajkot (A. Mashri pers. comm.) and in Naliya and Mandvi *talukas*, Kutch, from about 113 males (based on non-detection corrected estimates) in 2009 (Dutta 2012) to 80 males in 2011 and only 7–10 (based on total counts without non-detection correction) in 2017 (DG pers. obs.). This decline is attributed to recent major agricultural intensification and expansion—including encroachment of villages' common grazing land—together with infrastructure growth, livestock overgrazing and delayed, scanty and/or erratic rainfall patterns (DG, KG unpubl. data). The Bhal region, Bhavnagar, has been a stronghold (Gadhvi 2003), with an average 45±13 birds reported during 2010–2017, but increasing soil salinity, *Prosopis juliflora* invasion, agricultural intensification, pesticide use, disturbance and livestock trampling are all serious threats (DG, KG unpubl. data). In Ajmer district, Rajasthan, where numbers are largest, birds have adapted to agricultural fields due to the invasion of most native grasslands by *Prosopis juliflora* (Bhardwaj *et al.* 2011), but agricultural pesticides and industrial-scale mining are new major threats (Dutta *et al.* 2018). Near the former coal-mining centre of Warora, Vidarbha region, Maharashtra, industrial development involving new infrastructure, housing and powerlines, coupled with cotton production, poaching and biological invasions, have destroyed habitat (Narwade *et al.* 2015b). A wider study in Vidarbha found pastoral grassland largely replaced by agriculture, with *Parthenium hysterophorus*, *Prosopis juliflora* and *Lantana camara* invading the residue (Rokade *et al.* 2017). In Sailana, Sardarpura, Petlawad and adjoining areas, Madhya Pradesh, sightings of males fell from 64 in 1999 (Sankaran 2000) to nine in 2010 (Bhardwaj *et al.* 2011) and only two in 2017 (Dutta *et al.* 2018) as grasslands have given way to intensive soybean cultivation, with remnants either used for wind energy production and infrastructure development or overgrazed by livestock (Dutta *et al.* 2018).

Pakistan. There are 11 site-specific records (the most recent July 1986 and 1987 after an absence since 1964) from three provinces, Balochistan (5), Sindh (4) and Punjab (2), mainly from the July–October breeding period (including an egg in August and a chick in October), but surprisingly also one record each in January and February (BirdLife International 2001). Roberts (1991) considered the species to be a vagrant to Pakistan, although the 1986 and 1987 records of several birds from two distant Punjab sites might be evidence of the species's nomadism, a characteristic that seems important to factor into conservation planning.

Nepal. The species has been recorded between February and June from seven specific sites, prior to the main July–September breeding season (BirdLife International 2001). These records apparently reflect the seemingly unpredictable, facultative dispersal of non-breeding birds in South Asia.

Lesser Florican: overall assessment. Abundance in Gujarat grasslands peaks where grassland coverage of 50–100% is combined with ground-vegetation heights of 35–65 cm (Dutta & Jhala 2014). The seeming adaptation of the species to agricultural areas in Ajmer, Rajasthan (Dutta *et al.* 2018), needs checking to ensure that productivity is equal to that in grassland areas. The 'lack of a national policy on grassland management, habitat degradation, plantations, poor land use planning, pesticide pollution, inadequate coverage of florican habitats in the wildlife protected area network and lack of knowledge on the non-breeding habitats of this species are contributing to the steep declines (Bhardwaj *et al.* 2011). The strong cumulative indication of the available data, with only 270 males now estimated to survive, plus a series of local extinctions and evidence of mounting pressure at other sites (Dutta *et al.* 2018), is that the species should urgently be assessed for the IUCN category Critically Endangered. Although we list the various actions necessary for the species's conservation, these may be insufficient without a comprehensive understanding of the non-breeding habitats and threats to the species using bio-telemetry tools.

THREAT ASSESSMENTS

Habitat

Loss, degradation and disturbance. Extensive habitat loss and disturbance were identified at the start of the twenty-first century as the main threats to (and described in detail for) the Great Bustard, Great Indian Bustard, Bengal Florican and Lesser Florican (BirdLife International 2001). Subsequently, as the evidence here attests, the problem has only increased, not least owing to infrastructure developments—powerlines, roads, wind turbines, solar farms, industrial plants and mines, all of which reduce available habitat and are known or seem likely to increase disruption and disturbance to bustards and cause local extinctions (Sastre *et al.* 2009). Thus, the accumulated evidence suggests that change in land-use practices continues to be the driver that affects most bustard species in Asia.

Both Great and Little Bustard, recent beneficiaries of post-Soviet farmland abandonment, are predicted to suffer as their habitat reverts to agriculture (Kamp *et al.* 2011, Goroshko in press); in particular, the much commoner Little Bustard can be predicted to decline sharply, as seen in France since 1980 and Iberia since 2000 (Jolivet & Bretagnolle 2002, García de la Morena *et al.* 2017, Silva *et al.* 2018). Even Asian Houbara, whose distribution and productivity are unaffected by present livestock levels in the Kyzylkum Desert, Uzbekistan (Koshkin *et al.* 2014, 2016a,b), has disappeared as a winter migrant to the Arabian Peninsula due to habitat degradation in combination with hunting (Combreau *et al.* 2011). In South Asia, habitats of Great Indian Bustard, Bengal Florican and Lesser Florican continue to be turned over to intensive cultivation, whilst invasions of exotic plant species such as *Prosopis juliflora* alongside ill-planned plantations in grasslands represent another major, albeit more recent, cause of habitat loss for Great Indian Bustard and Lesser Florican (SD, YVJ pers. obs.). Disturbance, although difficult to quantify in terms of degree and effect, is a type of 'habitat loss', with the impact of tourists and/or photographers reported to be potentially serious for Great Indian Bustard and Bengal Florican in protected areas (Dutta *et al.* 2013, Collar *et al.* 2015, HSB pers. obs.); but other disturbance, from farm machinery to increasing traffic, may also take a toll (e.g. Tarjuelo *et al.* 2015). Protected areas that hold Critically Endangered species ought automatically to be managed to benefit their overall status and needs, and yet management practice in most grassland reserves in India and Nepal where Bengal Floricans occur is often contrary to their requirements (Sankaran & Rahmani 1990, Rahmani 2001, Dutta *et al.* 2013, DNPWC 2016, Rahmani *et al.* 2016, 2017).

System shortcomings. An important issue specific to bustard conservation in India is that of bureaucracy and delay, due to 'the absence of accountability, i.e., specific responsibilities, of the relevant departments to ensure sustainable land resource management in bustard landscapes' (Dutta *et al.* 2013). India's Revenue Department categorises most bustard habitat under its jurisdiction as 'revenue wasteland'. These areas are mostly neglected and prone to encroachment by farmers, as has happened on a large scale in

Rajasthan and Gujarat, leading to the permanent loss of Great Indian Bustard breeding sites. In Gujarat 'huge areas of Revenue "Waste Land" have been given away for industrial development and infrastructure... [causing] large-scale fragmentation of [Great Indian Bustard] habitat in Abdasa *taluka*', and this has further encouraged encroachment by farmers hoping to claim compensation if land is later allocated to industry (Gadhavi *et al*. 2012). In the Thar Desert, Rajasthan, 75% of priority Great Indian Bustard conservation sites are outside protected areas, with most being 'threatened by hunting and unplanned land uses' (Dutta *et al*. 2014), whilst Mokla grassland (about 50 km^2) in the 'GIB Arc' (Collar *et al*. 2015) has been converted to scrub by misguided planting of exotic *Acacia tortilis* (GSB pers. obs.).

Grass-fires. An issue particularly affecting Great Bustard is anthropogenic grass-fires. Burning the previous year's dry vegetation is widely practised in Russia in spring, particularly in May, to improve pasture quality; but the fires frequently get out of control over wide areas and in any one year affect 20–80% of Great Bustard breeding habitat, leading to 30–50% of females in affected areas losing chicks and causing an average annual loss in productivity of 5–40% (Goroshko 2002, 2008, in press; also AAN pers. obs. [for Omsk]).

Poisoning. A second issue specific to Great Bustard but capable of affecting all species is poisoning. In Russia pesticides were responsible for the deaths of 13 *dybowskii* Great Bustard in Zabaikal'skii Krai between 1970 and 1990. The post-Soviet collapse of intensive agriculture gave a respite from chemical use until 2010, but this threat to the small remaining populations is again very real, given the species's close association with arable land (Goroshko 2002, 2008, in press). The danger is indicated by the situation in China, where carbamate and organophosphate pesticides (mainly carbofuran) are used intensively on crops (OAG, GL pers. obs.). Of 55 birds brought for rehabilitation in Cangzhou, Hebei province, between 2002–2009, 20 were diseased, 18 injured and 17 (31%) poisoned, either as an unintentional side-effect of farming or as a deliberate strategy by poachers to secure birds for sale as 'wild' food (Meng 2010).

Climate change. Shifting precipitation and thermal patterns this century are predicted to affect birds' habitats, ranges and migratory behaviour, intensifying anthropogenic threats including disturbance, overgrazing and grass-fires and thereby increasing extinction risks (Estrada *et al*. 2016, OAG pers. obs.). While the response of bustard populations to global warming has not been modelled, the sparse evidence is discouraging. Dry conditions since 2000 have caused Great Bustards to desert the eastern Mongolian steppes almost completely, including Mongol Dagur protected area, and parts of Transbaikalia, Russia, including Daursky Nature Reserve (OAG pers. obs.). Great and Little Bustards are known to be sensitive to higher temperatures, which cause them to reduce metabolic rates and activities, constraining time for breeding and foraging, and potentially affecting individual fitness, population dynamics and migration patterns (Alonso *et al*. 2009, Silva *et al*. 2015). Great Bustard in Mongolia and Bengal Florican in Cambodia appear to display less frequently on warmer days, suggesting that rising temperatures may result in adverse demographic responses (AEK, SPM pers. obs.). Rising temperatures in South Asia, including areas where Bengal Florican occurs, are already predicted to cause 'deadly heat waves' (Im *et al*. 2017). Melting glaciers and extreme weather may disrupt the ecological processes that produce the Brahmaputra grasslands on which the Bengal Florican depends (GAJ pers. obs.), although the effects of dams currently planned or under construction on many Himalayan rivers may be more significant (SD pers. obs.). Erratic rainfall patterns caused by climate change (Goswami *et al*. 2006) are perhaps more important for Great Indian Bustard and Lesser Florican than temperature rise, as both species are known to abandon breeding in droughts (SD pers. obs.).

Powerlines

Powerlines are proving to be a very serious threat to all Asian bustard species; bustards are particularly vulnerable to collisions with overhead cables due to their head structure, with eyes arranged for >300° vision (Martin & Shaw 2010). Even well-marked powerlines cause fatalities, and also effectively fragment habitat by causing birds to avoid their proximity (Silva *et al*. 2010b). In many parts of Asia networks of overhead cabling carrying power into ever smaller and remoter regions and communities have expanded rapidly. Moreover, in relatively unproductive areas—albeit good bustard habitat—land has been allocated to wind and solar power generation, as in north-west India, requiring lines to transmit power out of remote areas. This two-way phenomenon is a threat whose magnitude has exploded in the last 10 years.

In one part of Spain, powerlines caused 37.6% of male Great Bustard deaths, possibly producing a change in migratory behaviour (Palacín *et al*. 2017). Across Iberia powerlines kill 3.4–3.8% of Little Bustards a year and are a major contributor to the species's catastrophic decline there since 2000 (Faria & Morales 2018). In Portugal, dismantling or re-routing some lines has been advocated (Silva *et al*. 2010b, 2014b) while in Austria burying powerlines has been demonstrated to be the best solution (Raab *et al*. 2012). Evidence of Little Bustard losses in central Kazakhstan (Voronova *et al*. 2012) suggests that the sparse but extensive network of powerlines may be a threat to this species during their migrations. In Uzbekistan the Asian Houbara may suffer 3% losses annually on the breeding grounds alone (Burnside *et al*. 2015), and the species has suffered fatalities at new powerlines across the Mongolian Gobi (Dashnyam *et al*. 2016, AEK, NB pers. obs.); it is worth noting that 11.5% of the African Houbara population on the eastern Canary Islands, Spain, died on powerlines in a single year (García-del-Rey & Rodriguez-Lorenzo 2011). In Shaanxi province, China, 75% of injuries to wintering Great Bustards brought in for rehabilitation between 2004 and 2012 were due to powerline collisions (Liu *et al*. 2013). Mortality rates will only increase in Central and Inner Asia as resource extraction and power generation infrastructure in the region continue to develop.

Great Indian Bustard is steadily losing adults to overhead cables (Patil *et al*. 2011, Collar *et al*. 2015, Narwade *et al*. 2015a, Dasgupta 2017, Dutta 2018). Altogether nine such fatalities have been recorded in the past decade, four in 2017, making powerlines the single most serious threat to the survival of the species (Dutta 2018). In Cambodia, powerline construction across the Tonle Sap grasslands represents a new and possibly terminal threat to the Bengal Florican subspecies *blandini* (Mahood *et al*. 2018), with the environmental impact assessment recommending fitting bird diverters to only the most dangerous section (SPM pers. obs.). Although powerlines have not yet been reported to threaten Bengal Floricans in South Asia, a powerline now crosses the Koshi Tappu grasslands in Nepal (Baral *et al*. 2013). In India Lesser Florican has been recorded colliding with overhead cables (BirdLife International 2001), and as a wide-ranging migrant it may suffer far more than previously appreciated, with fatalities being spread over large areas and the relatively small corpses escaping notice.

Hunting

Overview. Hunting of bustards by all means, including falcons, is illegal across Asia, except by Arab dignitaries targeting Asian Houbara under licence. Nevertheless, hunting today has the capacity to exterminate bustard populations as well as cause disturbance and stress which reduces productivity and long-term survival (Sastre *et al.* 2009, Tarjuelo *et al.* 2015). For the past 200 years, unbridled hunting has been the main cause of Great Bustard declines in Asia, and is a major threat to its survival today (Chan & Goroshko 1998, Goroshko 2000, Nefedov 2002, Kessler & Smith 2014). Hunting in the region is intensifying as urban wealth, weapon quality and accessibility of previously remote areas improve. Throughout Eurasia, a heavy death toll, particularly on wintering flocks, is inflicted with impunity—we know of only one recent case where perpetrators were prosecuted (Berezovikov & Filimonov 2017)—by wealthy, well-connected hunting parties, often involving government officials and occasionally European and Arab tourists (Archimaeva *et al.* 2013). In Russia, hunting is the most serious threat to *O. t. dybowskii*, with 218 (89%) of all 245 deaths recorded in Zabaikal'skii Krai, Transbaikalia, attributed to it, and 20–50 birds still shot annually (Goroshko in press); the density of game guards in unprotected areas of Siberia where 95% of Great Bustard habitat is found is as low as one per 5,000–30,000 km^2 (OAG pers. obs.). In China, hunting commonly involves poisoning to sell the meat to 'wild food' restaurants, threatening human health as well as the species (Wu *et al.* 2013), but hunting with dogs and rifles is also widespread—in November 2017, eight injured birds were found in Cangzhou, Hebei province (YZ pers. obs.). In Uzbekistan, poaching of wintering Great Bustard, including for market sale, has been rife since the mid-twentieth century (Meklenburtsev 1953); on one occasion most of a flock of 200 were killed (Kreitsberg-Mukhina 2003). Over half of rural residents familiar with the species across 2,400 km of western Mongolia had (or knew someone who had) poached it, posing a terminal threat to the small residual Ubsunur population isolated by 500 km, with about 10 birds in Mongolia and 30 in adjacent Tuva (Kessler *et al.* 2016, AEK pers. obs.).

The recovery of Little Bustard populations after the post-Soviet de-intensification of farming in parts of Russia and Kazakhstan raises the question why Great Bustard numbers did not improve. The explanation is probably hunting on wintering grounds in Almaty region, southern Kazakhstan, where anecdotal information suggests that affluent urban hunters using long-range rifles shoot birds from 4×4 vehicles (Berezovikov 2011). In snowy weather Great Bustards are particularly vulnerable, often gathering on arable fields—especially unharvested *Soja hispida*—close to roads easily accessible to poachers; 30 out of 100 birds were shot in the Alakol depression in winter 2009–2010 by poachers on snowmobiles (Berezovikov & Levinskii 2010). In East Kazakhstan, poaching has recently been claimed to remove 25–30% of overwintering Great Bustards annually (Berezovikov & Levinskii 2012), a truly alarming statistic. Great Bustards, particularly large males, are obviously easier targets than Little Bustards, and poaching the larger males may affect the sex ratio in a way that compromises the viability of populations.

Nevertheless, an estimated 30,000 migrant Asian Little Bustard are illegally killed annually in east Europe, mainly Azerbaijan (Iñigo & Barov 2010), where they often gather in large groups on traditional sites year after year (Gauger 2007). Almost exclusive use of well-patrolled borderland areas by birds wintering in Iran is plausibly explained as an adaptation to avoid hunters (Yousefi *et al.* 2017). A spate of killings of migrants in Lebanon over the past five years (Ramadan-Jaradi *et al.* 2017) suggests that birds wintering in the Middle East are also exposed to strong hunting pressure.

Falconry, poaching and falconry-related trade. Hunting and poaching pose the main threat to Asian Houbara: what has been termed 'technofalconry' (Bailey *et al.* 1998) has combined with increasing local capacity, greater access to guns, better roads, better communication systems for hunters, and increased opportunity (hunting restricted to winter before the collapse of the Soviet Union is now continuous from autumn to spring) to exert pressure that wild populations evidently cannot absorb. The large hunt totals (see under 'Pakistan' Asian Houbara, page 6) are doubtless minima; Arab falconers are very discreet about their activities, while local poaching is, by definition, illegal and therefore mainly clandestine. Three out of four satellite-tagged birds in one study were probably killed by hunters in Central Asia (Judas *et al.* 2006). Of 103 wild adults fitted with transmitters in Asia between 1994 and 2008 by the National Avian Research Center of Abu Dhabi and followed for a total of 54,379 PTT-days, 47 were lost to certain or strongly suspected human interference and 18 to suspected predation, the remainder being followed until transmitters failed; annual mortality of adults migrating through Asia was 35.4%, of which 76.5% was probably or certainly due to human interference and 23.5% to suspected predation (OC unpubl. data). Estimated overall annual mortality between 1994 and 2000 was 28.3% (Combreau *et al.* 2001), implying that hunting increased notably between 2001 and 2008. Mortality, broken down by seasonal location, was (% time spent at a location in brackets): breeding grounds 15.5% (57.9%), autumn passage 10.3% (7.7%), wintering grounds 56.9% (26.6%) and spring passage 17.2% (7.8%)—hence 84.5% occurred away from breeding grounds (probability of mortality 7.5 times higher), essentially due to unregulated hunting (OC unpub. data). This mortality rate outstrips the capacity of the species to replace its losses, with a maximum sustainable yield estimated at 7.2% but with evidence that as much as 20.8% were hunted in the first part of the study (Combreau *et al.* 2001), increasing to 27.1% when the two parts of the study are pooled (OC unpubl. data). Monitoring of the breeding population in the Kyzylkum desert, Uzbekistan, since 2012 suggests that it is declining at 9.4% per year (Dolman *et al.* submitted).

It is noteworthy that population increases in Betpak Dala and Kyzylkum, Kazakhstan (Riou *et al.* 2011), occurred soon after the 2001 launch of the military campaign 'Operation Enduring Freedom' in Afghanistan, which may be assumed to have inhibited Arab falconers from hunting there; satellite-tagged birds from those breeding areas were found to winter in Afghanistan, and it is reasonable to speculate that hunting reduction allowed the recovery of these populations. It is also worth noting that a 2009 survey of 113 Gulf states falconers found that 66% of them believed Asian Houbara were declining, with 58% blaming 'unregulated hunting' and 27% blaming 'illegal trade', probably for training falcons (Al Kharusi & Al Ameri 2011).

This falcon-training trade is a major but poorly recognised problem. Falcons do not naturally hunt houbara and must be trained to do so, by developing a 'search image' and learning from experience, for which live bustards are needed (a houbara-like drone is now being marketed to perform this task). Goriup (1997) estimated that 4,000–7,000 birds were traded from Pakistan to the Gulf states annually for this purpose, but research in the early 2000s suggested that 7,000 live houbara were illegally imported to the United Arab Emirates alone annually for falcon-training (Tourenq *et al.* 2005); Kuwait, Qatar, Bahrain and Saudi Arabia are probably also involved, so a credible estimate of annual houbara imports for falcon training could be of the order of 20,000.

Hunting of the resident Oriental species. Poaching of the three resident Oriental species is very poorly documented, but hunting of Great Indian Bustard is a serious issue in Pakistan, at the western limit of the Thar Desert population (Khan *et al.* 2008). In India, paucity of reports does not imply low levels of hunting so much as poor detection rates, and hunting cannot be assumed to be unimportant —cases of Great Indian Bustard hunting were registered in 2012 and 2013 in Jaisalmer (GSB pers. obs.).

Predation

Predation is a natural phenomenon that drives selection, regulates numbers and, in environments little affected by human activity, does not and should not require intervention. However, anthropogenic activity inflates bustard predation rates in two ways: by producing increases in the range and numbers of generalist predators such as corvids, foxes and dogs (Young *et al*. 2010, Doherty *et al*. 2017), and—as an aspect of the problem of habitat modification—by reducing the height and extent of vegetation in which bustards can find cover, through overgrazing, short mowing and early ploughing (Marcelino *et al*. 2017).

In Mongolia, wheatfields attract large numbers of foxes and corvids, and nesting Great Bustards suffer egg and chick losses (foxes also kill females); moreover, traditional nomadic pastoralists use free-ranging herding dogs, a very serious threat to nesting bustards (AEK pers. obs.). In Omsk province, Russia, the natural re-establishment of a bustard breeding population in remnant steppe was prevented by feral dogs, numbering at least 300 in each of seven different areas, with superabundant Rook *Corvus frugilegus* populations compounding the problem (AAN pers. obs.). In Uzbekistan, mortality of juvenile and naïve captive-bred Asian Houbara that wander into desert near agricultural land is notably greater (RJB, PMD unpubl. data), and in South Asia fatalities of tagged Bengal Florican coincided with their moving from reserves to adjacent farmland (Jha *et al*. 2018), both cases implicating hunting, dog predation or both. Feral dogs have increased dramatically in India since the demise of vulture populations—canine bites in Kutch rose by 46% from 2009 to 2012 (DG, KG unpubl. data)—and dogs have been recorded attacking Great Indian Bustard and Bengal Florican (Home *et al*. 2017). Free-ranging dogs and other opportunistic predators—Asiatic Golden Jackal *Canis aureus* and Indian Grey Mongoose *Herpestes edwardsii*—may today threaten Bengal Florican in Nepal, especially at Koshi Tappu (Baral *et al*. 2013). Domestic and feral dogs probably significantly affect breeding Bengal Florican in Cambodia, since all populations are within 20 km of a village (HC, SPM pers. obs.).

CONSERVATION RESPONSES TO THE THREATS: OVERVIEW

Habitat

Habitat management at landscape-scale. With the exception of Bengal Florican, bustard ranges in Asia mainly lie outside protected areas, leaving species heavily exposed to anthropogenic land-use changes. Habitat management for bustards is therefore a cardinal conservation issue that is related to the wider human stewardship of landscapes more than to the narrower one of nature reserves.

Some bustard populations tolerate and even thrive in 'extensively' managed (rather than intensively farmed) landscapes, i.e. areas where hunting is controlled and which are maintained by low-impact techniques, with no or low levels of disturbance, mechanisation, chemical input and fencing (Wolff *et al*. 2001, Gray *et al*. 2007, Palacín *et al*. 2009, Dutta & Jhala 2014). Greater breeding success is a key result of this; more intensive regimes of livestock and agricultural management reduce productivity of ground-nesting birds through nest and chick losses to disturbance, trampling, harvest machinery, predation and depleted food resources (Chernobai *et al*. 2011, Guerrero *et al*. 2012, Faria *et al*. 2016). Studies of Great Bustard (Raab *et al*. 2015), Little Bustard in winter (Gauger 2007) and spring (Silva *et al*. 2010a) and Lesser Florican (Dutta & Jhala 2014) also show that bustard densities are positively correlated with the extent of continuous habitat. Moreover, breeding Little Bustard (and probably all species) are found in high densities in landscapes with areas of long-term fallows and permanent pastures (Moreira & Leitão 1996, Silva *et al*. 2010a, 2014a), which continuously retain sufficient appropriate vegetation for nesting, display and cover; the broad availability of such habitat favours the spatial and temporal dynamics of lekking males (Silva *et al*. 2017). Management interventions involving planting appropriate crops have been demonstrated to benefit bustard populations (Bretagnolle *et al*. 2011, Raab *et al*. 2015), whilst in India partial mowing and ploughing of grassland in enclosures to produce a proportionate increase in herbaceous cover have improved Great Indian Bustard occupancy (Bhardwaj *et al*. 2017), this being attributed to better cover, but probably also because of greater food availability (Morales *et al*. 2008).

Both bustard sexes need relatively tall vegetation for cover, but displaying males select shorter vegetation in which to be seen during display (Rahmani 1989, Moreira *et al*. 2004, Hingrat *et al*. 2007, Morales *et al*. 2008, Gray *et al*. 2009b, Koshkin *et al*. 2016a). Breeding habitats therefore have to be managed for both sexes. Similarly, differences in nesting habitat between sympatric Great and Little Bustards—Great mostly in crops and (where unploughed) stubble, Little mostly in steppe and long fallow (Shlyakhtin *et al*. 2004, Magaña *et al*. 2010, Rocha *et al*. 2013, Morales *et al*. 2013)—mean subtly differential habitat management for these species (Tarjuelo *et al*. 2014), also recognising that Great Bustard density constrains Little Bustard niche-width (Tarjuelo *et al*. 2017).

The unpredictable nature of Great Bustard migratory movements in Asia creates further challenges. In Central Asia *O. t. tarda* migration varies with winter weather severity (Kessler & Smith 2014), whilst in east Asia *O. t. dybowskii* routes vary individually and from year to year, with females spending four months on migration, making several stopovers at locations they may not visit again in later years, and four months wandering in winter quarters (Kessler *et al*. 2013). This behaviour makes the identification of stopover sites and important winter habitat difficult, and reinforces the need for conservation measures at landscape scale; it also creates problems for agencies responsible for controlling poaching. Asian Houbara likewise use a broadly similar migration route year on year but vary stopover locations (RJB, OC, PMD unpubl. data). Great Indian Bustards, Bengal Floricans and Lesser Floricans also seem to wander somewhat randomly in the non-breeding season (BirdLife International 2001, Habib *et al*. 2016, SPM pers. obs.).

Management of existing nature reserves. Most obviously, careful and rigorous management of existing nature reserves to improve habitat, including removal of invasive vegetation, is an urgent, vital component which provides the opportunity for maximal productivity. However, as bustards are mobile and live at densities too low to survive and thrive in protected areas alone, the management of the wider landscape is no less crucial. This means the maintenance of extensive (low-impact) farming and grazing, with minimal mechanisation, minimal application of fertilisers and pesticides, minimal disturbance and disruption, restricted irrigation, and the assured continuity of habitats through the maintenance of long-term fallows and permanent grassland areas. A number of species will benefit from a reduction of grazing, to allow grassland to recover and the sowing of favoured crops and ploughing and mowing areas to achieve appropriate levels (in both extent and height) of herbaceous cover. Such measures, in nature reserves and state-owned lands at least, may greatly enhance breeding productivity. Moreover, because these landscapes hold proportionately more bustards as their size increases (see above), continuous unfragmented habitat is a critical management target (and one that will allow species greatest opportunity to adapt in the face of climate change). This includes the need to minimise and mark new fencing to reduce mortality in the larger, less manoeuvrable species.

Landscape planning. The minimisation of fencing is also important to allow for the social dynamics of bustard populations based on their semi-gregarious behaviour and (mostly) 'exploded lek' mating systems. Breeding bustards commonly show a pronounced tendency to aggregate (Collar 1996, BirdLife International 2001, Morales *et al*. 2001, Alonso *et al*. 2004, Pinto *et al*. 2005, Jiguet & Bretagnolle 2006), leaving extensive areas of apparently suitable habitat largely unoccupied (Lane *et al*. 2001) and potentially generating increased density-dependent competition for resources or greater vulnerability to catastrophic events (Morales *et al*. 2001).

Landscape planning for bustard conservation in Asia must therefore seek uncompromisingly for the strong protection of considerable expanses of suitable habitat in which the birds' social dynamics can function without constraint. Thus, although the conservation of lekking sites is a priority (Lane *et al*. 2001), the interconnectivity of such sites must equally be maintained, as well as the breeding habitat occupied by females in the broader landscapes away from leks. Large reserves in little-disturbed landscapes are essential and must be the ultimate vision of bustard conservationists in Asia, even if practicalities demand compromise.

Inevitably, therefore, enlisting and empowering local people, not only to warden and protect landscapes from illegal hunting but also—and primarily—to support extensive farming practices, is a vital measure. However, without ongoing subsidies, farmers cannot be expected to practise extensive farming instead of more lucrative, usually intensive, methods (Wright *et al*. 2012); the needs of communities must be continually integrated into adaptive management of bustard conservation programmes.

Castro Verde in southern Portugal is a model for the regeneration of bustard populations through appropriate management of extensively (i.e. non-intensively) managed farmland. Great Bustard was discovered there in 1977, and 243 were counted in a 1979 survey (Collar & Goriup 1980). In 1994–1995, less than 10 years after Portugal joined the European Union (EU), the area was the subject of an agri-environmental programme targeting steppe bird conservation, including Great and Little Bustard, by maintaining and promoting traditional low-intensity rotation of dry cereal farming and long-term (2–4 years) fallows, controlling poaching, and restricting and marking powerlines (Rocha 2006, Delgado & Moreira 2010, Santana *et al*. 2014, JPS pers. obs.). In 1999 the site was given Special Protection Area (SPA) status (Anon. 2015b), and by 2002, eight years into the project, Great Bustard numbers had risen from 414 to 912 (Pinto *et al*. 2005) and by 2005 to 1,100 (Rocha 2006). In 2008 the SPA was expanded to its current 85,345 ha and in 2014 the bustard population was 1,218 (P. Rocha *in litt*.), a three-fold increase in 20 years, although there was probably some immigration of birds from other areas caused by land-use changes (Pinto *et al*. 2005). Little Bustard numbers also increased despite a 50% decline in the species's Portuguese population since 2003 (Silva *et al*. 2018).

Relevant existing national legislation in the region

Russia. Farmers are required by law to preserve rare species on their land, but economic circumstances prevent them from complying; consequently a new type of protected area, the 'agricultural park', where farming compatible with bustard conservation is subsidised, is being advocated (Goroshko in press).

China. Some 50,000 community reserves have been established, encouraged by entitlements and approvals from central government but driven by local interest and bringing economic well-being to local people (GL pers. obs.). There is an opportunity to use community reserves for bustard conservation, although existing agricultural land inside current protected areas needs to be adequately protected and planted with crops that will help birds survive harsh winters (GL pers. obs.).

India. Provision also exists under Indian law for the creation and protection of landscapes that can be managed as government-community partnerships, akin to the system at Castro Verde. As noted by Dutta *et al.* (2011): 'the new categories of PAs [protected areas] introduced in Indian legislation such as (a) Conservation Reserve, (b) Community Reserve, and (c) Ecologically Sensitive/Fragile Area [Section 31A of Wildlife (Protection) Amendment Act 2002 (2003); Section 5 of Environment (Protection) Act 1986] can better protect bustards and their habitats on lands having government/private mixed ownerships... Such procedures will not require land acquisition or people displacement but will allow sustainable use of larger areas with participation from local communities and essential intervention of the Government...'.

A 'conservation reserve' can be declared if the area is uninhabited and solely owned by the Government of India, while a 'community reserve' can be declared if part or all of the area is privately owned. Both promote community livelihoods (rotational grazing, restoration of commons, organic farming) compatible with wildlife conservation (AUC, DG, KG pers. obs.). These reserves typically act as wildlife corridors between higher-ranked protected areas or as buffer zones, and are intended for local community subsistence (www.wiienvis.nic.in). Existing protected areas can also be buffered by the designation of 'eco-sensitive zones' (ESZs), in which large-scale land-use changes and polluting industries are prohibited and activities such as ecotourism encouraged (MoEF 2011). These instruments need research and implementation in key areas for the Great Indian Bustard, Bengal Florican and Lesser Florican with the utmost speed.

Cambodia. Conversely, the Cambodian government has no appetite to create new reserves for Bengal Florican because there is no unmodified habitat in which to locate them; consequently priority must go to linking existing small reserves by means of areas of community-managed low-intensity agriculture (SPM pers. obs.).

Powerlines

Given the huge construction costs of powerlines, and even of retrofitting lines with diverters, it cannot be stressed strongly enough how much better prevention is than cure. Governments, industry and lending agencies must be sensitised to the immense damage powerlines inflict on bustards and other avian species. All environmental impact analyses must directly and fully address this issue. Conservationists must be alert to new plans for powerlines long before construction starts, and they must not compromise in their opposition to developments likely to damage bustard populations. Powerlines across or close to areas being managed for bustards must be vetoed, re-routed or buried, while powerlines in the wider vicinity must be routed across the least used areas (bordering larger roads, which bustards tend to avoid, may help) and marked with the most effective and durable flight diverters (although at present there is no clear agreement on which of many types performs the best), with a permanent budget for the replacement and improvement of diverters over time.

In Jaipur and Jodhpur during 2016–2017 conservation agencies and the energy sector agreed that bird diverters will be fitted to existing powerlines and no new wind turbines and powerlines will be erected in the priority Great Indian Bustard habitat around Jaisalmer (Dutta *et al.* 2016) but, apart from some pilot installations of diverters provided by the Wildlife Institute of India, large-scale implementation is slow (GSB, SD pers. obs.). Similarly, an order by the Collector of Kutch to bury all powerlines crossing bustard habitat and to mark others with diverters with immediate effect is being ignored (DG, KG pers. obs.).

Hunting

Specific recommendations to control hunting and poaching are made for each species below, but all countries must fulfil their obligations to two international agreements to which they are signatories: the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on Migratory Species

(CMS). However, it should be noted that Turkmenistan is not a signatory to CITES, and China, Russia, Nepal and Turkmenistan are not party to CMS although they are party to one or more of the agreements and/or have signed one or more of the CMS MoUs.

Asian Houbara is listed in CITES Appendix I, which prohibits all forms of international trade in wild-caught birds, except in exceptional licensed circumstances, and controls trade in captive-bred birds via a system of permits. This law applies to the shipments from Iran and Pakistan to the Gulf states for falcon-training purposes. However, legislation to comply with CITES obligations remains to be completed in Afghanistan, India, Kazakhstan, Kyrgyzstan, Pakistan and Mongolia (https://cites.org/sites/default/files/eng/prog/Legislation/ CITES_national_legislative_status_table.pdf), whilst existing legislation must be properly enforced in all Asian countries where bustards occur.

Great Bustard is listed in Appendix I and Asian Houbara in Appendix II of CMS. A draft conservation agreement and an action plan for Asian Houbara (UNEP/CMS 2005) was prepared but to date has not been opened for signature. However, at the CMS Conference in November 2017 unanimous support was given to a 'Proposal for Concerted Action for the Great Bustard in Asia', covering China, Iran, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenistan and Uzbekistan, to provide a framework for greater communication and coordination between national conservation agencies; this represents a key mechanism through which the hunting problem may be addressed.

The conservation of sufficient wild Asian Houbaras to meet the demands of Arab falconry will require scientifically determined quotas, networks of strictly protected areas and cadres of well-trained, well-equipped game guards (see under Asian Houbara below).

Predation

A 2017 Asian Great Bustard conservation conference in Mongolia proposed measures such as restricting dog ownership, mandatory dog ID cards, fining owners of (or shooting) loose dogs, establishing seasonal dog exclusion zones, and educating dog owners (AEK pers. obs.). Such actions are, however, inapplicable in South Asia, where dog populations are largely feral, but garbage management around bustard habitat is an urgent essential objective. In India animal birth control (ABC) programmes to control dog numbers were ordered by the Supreme Court in 2016 but have been either ignored or contested (DG, KG pers. obs.). Despite earlier rabies control programmes achieving positive results (Totton *et al*. 2010), doubts exist about their adequacy (DG pers. obs., A. Vanak pers. comm.). The more radical approach of castrating dogs and eradicating them from critical wilderness areas has been advocated (Home *et. al*. 2017), and is currently being implemented in the Thar Desert (SD pers. obs.). Protected area staff need a clear, strong mandate to implement strong measures to control/eliminate dogs and other predators in a sensitive but effective manner.

The importance of adult survival and productivity

The mean natural life expectancy and period of reproductive activity of all bustard species are unknown, and, other than in *Chlamydotis* and *Ardeotis*, females are so much more cryptic and secretive than males that data on their ecology are largely non-existent. This knowledge deficit is a considerable obstacle to the modelling and management of the species in relation to the multiple threats they face.

In species such as the six bustards under review here, in which breeding success of younger birds is naturally low despite their sexual maturity (Morales *et al*. 2001), older individuals make disproportionately large contributions to the stability and continuity of the populations; consequently, large declines in numbers can result from even small declines in the survival rates of older birds. Great Indian Bustard populations are so sensitive to the loss of adult birds that 'Even the largest population can plummet to extinction with a constant additional loss of one adult to human causes each year' (Dutta *et al*. 2011). Such losses are less the result of habitat destruction than of hunting and powerline collisions, both of which indiscriminately remove birds of all ages from the population. It is vital that conservation agencies comprehend that if these two threats are not fully addressed all other management interventions may be entirely futile.

Female survival is particularly important. Bustard populations with male-biased sex ratios have a greater probability of extinction (Inchausti & Bretagnolle 2005, Morales *et al*. 2005), with recent Spanish data indicating that rapidly declining populations of Little Bustards are strongly male-biased (MBM unpubl. data). Such bias points to reduced female survival during nesting—common causes being dogs and farm machinery—but also translates into reduced breeding productivity. Female survival and productivity rates have been shown to be critical to population maintenance in both Great Bustard (Lane & Alonso 2001) and Little Bustard, with the latter's population survival probability rapidly approaching zero when fewer than one chick per female per year survives (Inchausti & Bretagnolle 2005, Morales *et al*. 2005). Ensuring and enhancing fecundity must therefore be a central focus of all habitat management strategies.

The issue of captive breeding

Captive breeding of Asian Houbara was originally developed to supplement or reintroduce populations in Saudi Arabia where the species was actually or functionally extinct (Seddon *et al*. 1995, Saint Jalme & van Heezik 1996). However, in 1995 a breeding programme (Emirates Center for Wildlife Propagation) was initiated for the African Houbara 'with the aim of ensuring a self-sustaining use of houbara bustard populations in Eastern Morocco' (Lacroix *et al*. 2003). This model, seeking to maintain or even increase exploited populations by annual releases of large numbers of captive-bred birds, has come to dominate the Asian Houbara conservation agenda in the past decade, supplanting the need for restraint by hunters (Combreau *et al*. 2001, 2002, 2003). The International Fund for Houbara Conservation has released over 250,000 African and Asian Houbara since 1996 (http://www.houbarafund.org/en/ newsinfo/18), with breeding centres completed or planned in Saudi Arabia (1), United Arab Emirates (3), Qatar (1), Kuwait (1), Uzbekistan (2), Kazakhstan (1), Mongolia (1) and China (1) (Saint Jalme & van Heezik 1996, Allinson 2014, Collar *et al*. 2014, http://www.houbarafund.org/en /info/kazakhstan, http://www.reneco.net/references/). Thousands of captive-bred houbara are released in Central Asia annually, with some birds being transported to geographically distant sites by air (http://gulfnews.com/news/uae/government/2-000-captive-bred-asian-houbara-released-in-kazakhstan-1.1329406). Unfortunately, such re-stocking does not address the fundamental problem of over-exploitation of the wild resource, with survival rates of captive-bred birds too low to compensate for the continuing hunting of wild birds (Azar *et al*. 2016, Burnside *et al*. 2016, Dolman *et al*. submitted). Moreover, large-scale captive-breeding of houbara absorbs resources that are greatly needed for conservation projects such as anti-poaching campaigns and extensive (in both senses) habitat protection in Central Asia.

The fundamental problem remains that 'so little is actually known about the positive or negative impacts of the release of captive-bred birds on the species it is assumed to be supporting' (Burnside *et al*. 2017). There are several potential drawbacks. (1) Captive breeding inevitably selects for traits that affect the fecundity, quality, immune-genetics, digestive morphology, behavioural responses and survivorship of the birds (Dolman *et al*. submitted). (2) Despite the low fitness of released birds, these traits are likely to transmit by introgression to wild populations, thereby interfering with key natural selection processes in wild animals (Laikre *et al.* 2010, Villers *et al.* 2010); as bustard migrations are partly genetically programmed (Villers *et al.* 2010, Burnside *et al.* 2017), there is a possibility of impairing locally evolved migration strategies if released birds are not derived from locally sourced eggs. (3) Such releases surely risk intensifying local hunting and poaching interests and potentially also a change in or refinement of search-image by predators in the area (Gortázar *et al.* 2000). (4) There is a serious risk of transmitting pathogens to wild birds from captive ones bred on a large scale in unnaturally dense conditions, as happened to Little Bustard in Spain (Villanúa *et al.* 2006). Consequently, whether captive breeding of Asian Houbara in high volume is an appropriate conservation investment remains open to debate, although—welfare considerations aside—it could provide a solution to the problem of wild captures to service falcon-training interests.

Because there is as yet no easy way to determine whether birds hunted in autumn along migration routes, especially in Kazakhstan, Uzbekistan and Afghanistan, are passage migrants or local breeders, the origins of the hunted birds are unknown, and the impact of hunting on their populations cannot be predicted or modelled (Burnside *et al.* 2017). The benefits of releasing captive-bred birds into these populations are therefore far from certain, and in Pakistan the practice risks replacing (if it has not already done so) any residual resident population as well as depleting migrant populations.

Captive breeding of Great Bustard has been attempted unsuccessfully in Russia (OAG pers. obs.) and China (Tian *et al.* 2001, Lu & Tian 2011, Yao *et al.* 2011, Xiuhua Tian pers. comm., GL pers. obs.).

Captive breeding of Great Indian Bustard has also been proposed (Dutta *et al.* 2011, 2013), although demographic modelling indicates a low probability of success (Dolman *et al.* 2015). Collar *et al.* (2015) itemised 30 *in situ* remedial activities based on the national bustard recovery plans (Dutta *et al.* 2013) to offset the need for an *ex situ* programme. However, given the opposing priorities of anthropogenic development in bustard landscapes and the sluggish conservation response to date—too slow to save remnant populations in Maharashtra, Andhra Pradesh, Karnataka and Madhya Pradesh—experienced Indian conservationists and wildlife managers remain sceptical of the timely implementation of these remedies, giving their support to an *ex situ* programme as an insurance policy against imminent extinction, despite its inherent uncertainties, at a meeting of decision-makers in Jaipur in 2017 (GSB, SD, YVJ pers. obs.). The Indian government has allocated a separate budget of US$3 million for this *ex situ* programme, as a supplementary activity to buy time for the species. Whatever eventuates, there is agreement that captive breeding 'should not be considered as an alternative to effective large scale habitat management and protection which must be the highest priority by far' (Ishtiaq *et al.* 2011).

CONSERVATION RESPONSES AT SPECIES LEVEL

Little Bustard

Research. A coordinated research programme throughout the species's Asian range is a high priority to elucidate the status and needs of the various populations. Survey work undertaken to agreed international protocols is required to establish the distribution, size, conservation status and habitat selection of breeding populations in Asian Russia, Kazakhstan and China. Satellite-tagging of birds in these countries, Azerbaijan and Iran is needed to clarify migration routes used by specific populations and identify areas for management.

Hunting control. Laws prohibiting and/or regulating hunting need enforcement through increased investment in well-trained and motivated guards and game wardens, with a sustained media campaign, extending to the Middle East, targeting all hunters. In many places measures can be combined with those for Great Bustard.

Habitat management. Long-term fallows and old pastures favoured by the species in Kazakhstan, and which can be improved by low-intensity grazing, need to be preserved and also, where possible, created, the key objective being to establish the largest possible areas of continuous habitat. 'Land sparing' has been shown to be the least harmful way of increasing food production in Kazakhstan, i.e. agriculture should seek to increase the output of existing cropland 'using approaches such as snow accumulation, no-till and more efficient grain harvesting and storage, rather than... further reclamation of abandoned land' (Kamp *et al.* 2015). Large, long-term pastures need management either by use of light-to-moderate stocking rates (0.2–0.6 LU/ha), since birds require different vegetation heights suitable for both concealment and vigilance, avoiding ungrazed and overgrazed grassland and stubbles (Morales *et al.* 2008, Faria *et al.* 2012, Tarjuelo *et al.* 2013, Faria & Morales 2018), or by a strict system of pasture rotation that excludes grazing from (1) all land in the breeding season and (2) the same land in successive years (Silva *et al.* 2010a, 2014a). In the latter case, at least in Kazakhstan, where livestock is mainly kept close to villages, grazing should be more evenly distributed (Kamp *et al.* 2009).

Great Bustard (both races)

Research. Satellite-telemetry programmes will help clarify migratory and wintering behaviour, identify critical habitat and powerline danger-spots, and monitor reproductive success and mortality. The recent initiation of a concerted action plan for the species through CMS (see above) provides a framework for communication between teams, coordinating management and identifying best practices between conservationists across the Asian range.

Hunting control. Poaching must be addressed at all levels from government to local community, with heavy fines as punishment for members of elites and even loss of job for government officials. Wardens and guards will need training, resourcing and strong popular and political backing if they are to protect populations. Regulations on pesticide use, established by the Chinese State Council in 1997, require urgent revision to prohibit the use of carbofuran and related compounds in the environment (GL pers. obs.). Local conservation groups need support and development—in China citizen patrols already remove poison bait and deter night hunters in areas where birds gather (China Biodiversity Conservation and Green Development Foundation 2017), while in South Kazakhstan a local birdwatcher has become a 'caretaker' for a lek, counting birds and addressing activities that threaten them in the local community, and elsewhere in Kazakhstan more transparent channels have developed through which citizens can report poaching (AEK pers. obs.). In winter, agencies need to communicate with each other at a national and international level in order to respond effectively to birds' unpredictable movements. Planting crops for forage can retain previously migratory birds over winter (Berezovikov 2016), and this could be tried in cases where migrations are deemed especially risky.

Habitat management. Attempts to increase reproductive rates will require lek sites throughout the range to be identified, catalogued and prioritised for special proactive protection, with emphasis placed on the conservation of peripheral nesting habitat; in one study the mean lek-to-nest distance was 7.73 km (Magaña *et al.* 2011) and extension of protection 10 km from the lek boundary would be a reasonable requirement, although research on nest placement by race *dybowskii*, whose preferences may differ from nominate *tarda*, will help develop appropriate habitat guidelines. Most known leks are closely associated with wheat farming (Goroshko in press, OAG, AEK pers. obs.), so the creation of 'agricultural parks', with agri-environmental regulations or incentives similar to those used in Europe, is now vital. International agreements on protected areas are needed for populations that inhabit border areas, on the model of the Russian–Mongolian–Chinese Dauria International Protected Area, which includes Daursky State Nature Reserve, Russia, Mongol-daguur Strictly Protected Area, Mongolia, and Dalai Lake State Nature Reserve, China. Dog populations and grass-fires need to be controlled. Mortalities due to collisions must be minimised by major commitments to reduce the impacts of new infrastructure and natural resource development projects.

Asian Houbara

Research. National and international research programmes are needed to improve understanding of key aspects of the biology, ecology and migration of the species, identify areas for full protection, monitor populations, help determine and adjust hunting quotas and propose management interventions. Two essential elements of this project must be to gain understanding of the origins and proportions of migrants hunted in flyways, and the impacts, positive or negative, of different scales of release of captive-bred birds.

Hunting control. Representatives of stakeholder nations should meet together to establish, observe and enforce 'limits on the number of birds that can be harvested legally' (Allinson 2014). Hunting from the start of the breeding season to the end of summer must be completely banned in all countries, and confined to autumn and winter (October–February). It should be licensed by land concession allocations and the establishment of quotas, generated precautionarily from available data by an independent body which takes into account information on the number and distribution of captive-bred released birds and evidence on their survival rates. In parallel, conservation agencies should offer support to the Gulf states to develop satisfactory, sustainable hunting grounds in Arabia to meet the interests of Arab hunters in their own lands.

Well-trained and well-equipped teams of guards are needed in each country to supervise the hunting concessions, eliminate local poaching and guard the inviolate reserves. These teams should liaise closely with agencies responsible for the enforcement of CITES regulations and prevention of smuggling live houbara to train falcons.

Habitat management. A chain of protected areas should be established from China and Kazakhstan south to Pakistan where birds can breed and stop over on migration and hunting is permanently and strictly prohibited. Satellite-telemetry has already provided data (Combreau *et al.* 2011) to help identify such areas.

Great Indian Bustard

Habitat management. The Castro Verde model of land management for bustard populations needs careful examination, although considerable adaptation will obviously be needed—the Great Indian Bustard has low fecundity, is generally a more widely dispersed, lower-density species than Great or Little Bustard, and, perhaps most worryingly, occupies the dry periphery of its natural range in western India where drought may provoke significant movements and the abandonment of breeding. Nevertheless, the model's principal tenets—a large continuous area under strong but socially equitable management, minimisation of disturbance, promotion of extensive farming, and marking, burial and re-routing of powerlines—are valid, and can be complemented by strategically positioned enclosures to provide herbaceous cover for breeding birds and by the further provision of areas planted with appropriate bustard-friendly crops such as alfalfa (Dutta *et al.* 2013, Bhardwaj *et al.* 2017).

Management plan for Rajasthan. In Rajasthan, the priority habitat extends in an arc of land (the 'GIB arc') from the northern part of Desert National Park towards Salkha and Mokla villages to the north and in the east to the extensive dry savannah controlled by Indian Armed Forces and used for artillery testing near Pokhran (Dutta *et al.* 2016). The GIB arc has been proposed as an 'eco-sensitive zone', and the National Green Tribunal, Bhopal, has prohibited new wind turbines and powerlines in the area (SD pers. obs.). In the west the area extends to the proposed 'Bijnote Bustard Game Reserve' in the Cholistan desert, Pakistan, requiring cross-border agreement on management and protective measures (Khan *et al.* 2008). Urgently needed site-specific mitigation and conservation interventions include: (1) burial of critical sections of powerline; (2) predator-proof fencing and predator management in breeding enclosures; (3) patrolling by well-equipped staff and a volunteer warden programme; (4) restoration of agro-grasslands through the combination of (a) Revenue Department land re-allocation, (b) prohibition of intensive agriculture and industry, and (c) incentive-driven community pasture management to prevent overgrazing; (5) promotion of ecotourism (to increase awareness and local incomes) and controls on tourist camp activities; (6) publicity campaigns and livelihood programmes to encourage public support; and (7) mitigation of existing and restriction of further infrastructure (chiefly powerlines) (Dutta *et al.* 2011, 2013, 2014, 2016, Collar *et al.* 2015).

Management plan for Gujarat. In Gujarat, similar activities to create and manage a continuous area of about 200 km^2 in Abdasa *taluka* are under way, including the transfer of Great Indian Bustard habitat under the Revenue Department to the Forest Department for protection, and the acquisition of privately owned habitats to create a 'bustard corridor' (Gadhavi *et al.* 2012). The Corbett Foundation has been involved in several initiatives to establish a mutually beneficial environment around the tiny 2 km^2 Kutch Bustard Sanctuary, Lala village, Abdasa—including primary health care to over 40 local village communities, local livestock improvement, husbandry and sustainable grazing programmes, organic agriculture (green gram farming) and hydroponic fodder production to reduce overgrazing, educational awareness campaigns and advocacy (https://youtu.be/gzQ700zlyI4, https://youtu.be/dOnA8TNkerE) and preparation and implementation of the Kutch Forest Department species recovery plan, including restoring degraded habitat, transferring new habitat to the department's care, curtailing plantation activities, fencing-off potential breeding areas, training local communities, and dog sterilisation programmes (DG, KG pers. obs.). The most pressing need is to reduce the threats caused by powerlines and associated infrastructure to the area's remnant bustard population. Data on bird movements obtained from satellite-tagged birds are being used to identify powerlines for mitigation (Dutta 2018).

Bengal Florican

Research. In South Asia, a dedicated research-and-management team and programme is essential to improve the evidence base from which recovery interventions for the Bengal Florican are developed. A detailed, permanently curated geographic database of all records of the species and all known and potential grassland habitat is urgently required (DNPWC 2016). Specifically, the steep, rapid population decline in Uttar Pradesh must be investigated and, if possible, reversed (Rahmani *et al.* 2017). Detailed surveys (repeated every 2–3 years) should focus on established protected areas to obtain dependable data on numbers, areas, habitats, biology, threats and responses to management interventions, but cover all areas identified as potentially holding the species. Intensive tracking programmes, using advanced technology, need urgent implementation to elucidate wintering behaviour, distribution and habitat use (DNPWC 2016, Rahmani *et al*. 2017).

In Vietnam, a survey of the Mekong Delta grasslands might reveal a relict but salvageable population.

Habitat management. The research activities above should form the basis of an exhaustive rigorous study of land-use tolerance and habitat selection running parallel with (but perhaps over time modifying) immediate on-the-ground interventions. This study should aim to answer how grassland management in protected areas can provide adaptively and equitably for the needs of all threatened grassland mammal and avian species according to their global and local status (e.g. by 'rotational grazing, controlled burning, control of free-ranging livestock and protection of grassland plots to conserve seed banks', plus staggered/alternate cutting and burning to help create/maintain structurally different patches that provide varying forage and cover conditions for several species) while also (a) avoiding or at least balancing burning practices to prevent the invasion of natural scrub and exotic plants, and (b) 'balancing wildlife conservation with the sustainable utilisation of grasslands by local communities' (BirdLife International 2001, Kumar 2012, Dutta *et al*. 2014, DNPWC 2016, RRSJ pers. obs.). The proposed reintroduction of the (Vulnerable) Indian Rhinoceros *Rhinoceros unicornis* to D'Ering Wildlife Sanctuary (Rookmaaker *et al*. 2016) must be managed sensitively so that it does not affect the maintenance and development of grasslands for the (Critically Endangered) Bengal Florican.

The research-and-management programme team should work with (i) staff in all protected areas in which Bengal Florican breed to increase the total area of habitat for the species and (ii) local stakeholders (in India) around reserves to establish conservation reserves, community reserves and/or eco-sensitive zones to give appropriate enduring protection to adjacent actual or potential florican habitat. In India, 20 years ago, AUC recommended strengthening and extending the network of protected areas harbouring the species, including e.g. national park status for Dibang Reserve Forest and adjacent lands, extension of D'Ering Wildlife Sanctuary, and improved management of Dibru-Saikhowa National Park (BirdLife International 2001); such interventions are still needed. Grasslands in Katerniaghat Wildlife Sanctuary and Lagga-Bagga (part of Pilibhit Tiger Reserve), Uttar Pradesh, should be restored to encourage recolonisation (Sivakumar *et al*. 2014). In Nepal, Koshi Tappu management should incorporate adjacent grasslands under its protection, integrate conservation and livelihood needs, restrict use of machinery, and improve survey methodologies (Baral *et al*. 2013), whilst Chitwan National Park managers need to restore short grasslands in the core (at least 1,000 ha) and buffer (500 ha) zones, motivate local communities through conservation awareness programmes, and prepare a management plan for the species (Khadka *et al*. 2013). Community support and involvement is integral to any population recovery programme, and this predicates a series of initiatives with local stakeholders (DNPWC 2016). The threat posed by all existing and projected powerlines in the terai grasslands of India and Nepal must be assessed, and lines buried or marked accordingly; the powerline crossing Koshi Tappu needs particularly urgent attention.

Management plan for Cambodia. The Bengal Florican Conservation Areas (BFCAs) in the Northern Tonle Sap Protected Landscape need expansion and strong sustained commitment by all levels of government to a zero tolerance of encroachment, enforced by clearer demarcation, more effective patrolling, control of dogs and active habitat management. Existing encroachments of BFCAs by irrigated rice and scrub must be reversed, local communities better supported, and all floodplain land outside BFCAs monitored and strategically managed for florican conservation by zoning and demarcation, promotion of single-crop rice and legumes in fallows (Packman *et al*. 2014, Ibbett *et al*. 2017), educational programmes, improved law enforcement and the development of ecotourism to encourage local engagement in conservation (HC pers. obs.). The creation of new and extension of existing protected areas on the periphery of and outside the floodplain, together with habitat creation and support for low-intensity rice farming (rather than cassava) over a huge area (Hillard 2012), would protect wintering and passage floricans. Hunting probably continues at a low level and must be eradicated by all means including media campaigns to raise awareness of the species's legal status. Ongoing rigorous checks on the whole of the Tonle Sap powerline are required to assess its impact and ensure that the most dangerous section is marked as required in the EIA (Mahood *et al*. 2018).

Lesser Florican

Research. The Lesser Florican requires its own tailor-made comprehensive adaptive research-and-management team and programme, on similar lines to the Bengal Florican, to improve the evidence base by which to determine optimal recovery interventions. Comprehensive range-wide surveys following the lines of the recent national multi-agency exercise (Dutta *et al*. 2018) should be repeated every 2–3 years to obtain increasingly dependable data on numbers, areas, habitats, biology, threats and responses to management, from all areas identified as potentially holding the species. Tracking programmes similar to Bengal Florican are needed to understand movements, ecology and threats in the non-breeding season.

Habitat management. The research-and-management programme team should work with (i) staff in all protected areas in which Bengal Florican breed to increase the total area of habitat for the species, and (ii) local stakeholders around reserves to establish conservation reserves, community reserves and/or eco-sensitive zones to give appropriate enduring protection to adjacent actual or potential florican habitat.

Bhardwaj *et al*. (2011), Dutta & Jhala (2014) and Narwade *et al*. (2015b) made more specific proposals: (1) delineate current core breeding areas and important agro-grassland landscapes as a network of community or conservation reserves (managing florican habitat as grassland, interspersed with organic croplands and rotationally ungrazed pastures to provide optimal results at low production levels) to prevent conversion of private land to intensive land-uses (e.g. cash-crops), and to allow for the species's nomadic behaviour; (2) provide food-aid to small farmers through a public distribution system to compensate them for the low productivity in and near reserves; (3) incentivise local communities to practise florican-friendly agro-pastoralism (low-impact interspersed agriculture in about 30% of grasslands and limiting livestock grazing to about 30% of grasslands); (4) encourage strong community involvement and awareness through major publicity campaigns; and (5) review threats in and around these areas, with an emphasis on powerlines, identifying those that should be buried or marked, and generating site-specific programmes for control and eradication of invasive plants.

A SERIOUS EMERGENCY IN GLOBAL BIRD CONSERVATION

It is an irony in conservation that biologists tend to know much less about the size and trends of large populations than they do of small ones. Large populations require much greater investment to assess their status accurately. Reclusive, nervy and often patchily distributed in both time and space, bustards are especially difficult to evaluate, even in relatively small areas; the estimation of their numbers over very large areas is invariably a matter of informed guesswork, and only as these numbers fall does the accuracy with which they are reported begin to rise.

Nevertheless, the evidence compiled in this review unequivocally shows that the status of bustards in Asia is a serious emergency in global bird conservation. The five globally threatened species, Great Bustard, Asian Houbara, Great Indian Bustard, Bengal Florican and Lesser Florican, all experienced dramatic declines in the past century and, more worryingly, continue to do so in the present one, despite their long-time international red-listing—Great Indian Bustard was listed in Vincent (1966–1971) and all five were included, along with Little Bustard, 30 years ago in Collar & Andrew (1988). The Little Bustard, after a considerable revival in the wake of post-Soviet agricultural abandonment (and a downlisting to Near Threatened in 1994), seems poised to return to its historical downward trajectory in Asia, and has recently plummeted in its once great stronghold, the Iberian Peninsula (García de la Morena *et al.* 2017, Silva *et al*. 2018).

We identify four main threats to these species—habitat loss, degradation and disturbance; powerline impacts; hunting and poaching; and anthropogenically enhanced levels of predation—that vary in proportions between species and country. A cardinal piece of evidence for the importance of habitat is simply that one of the two rises in bustard numbers in Asia recorded by this review was produced by the abandonment from 1990 of intensive agriculture in the former Soviet states. A second insight is that the effect was only strong in the Little Bustard, not the Great, which is most plausibly explained by the facts that Great Bustards make much more attractive targets for hunters with modern high-powered rifles, and that constraints on hunting were loosened in this region simultaneously with the collapse of agriculture. The other rise in bustard numbers, that of the Asian Houbara in two areas of Kazakhstan, is linkable to the temporary suppression of hunting in Afghanistan by military activities. The actual and potential threats from powerlines (affecting all six species) and uncontrolled dogs (known to affect four) are two further inescapable issues that cannot be ignored.

If the impression exists that these problems are intractable, this is perhaps only because so little has been done to address them. Such inaction certainly justifies the view that the total extinction of bustards in Asia is a very real prospect by 2050. Nevertheless, this review provides the evidence base on which solid recovery programmes can be built. In all cases the categorical imperatives are to reduce premature adult mortality and increase reproductive output. We advocate the setting of clear time-bound objectives as firm incentives for managers to initiate immediate interventions. It is, however, a daunting and inevitably expensive undertaking. The severity and impact of the four main threats to bustards vary with region, time and species, and it is difficult and potentially misleading to evaluate their relative importance; but perhaps the single most important message to emphasise here is the precautionary proposition that all threats to a species should be managed in one integrated programme. Any one threat, if neglected, may have the capacity to exterminate bustards in an area; attending to only one, two or three but not all of them runs a real risk of rendering all other conservation effort and expense ineffective and futile.

The inexorable corollary of this recognition is that the conservation of these species cannot depend only on local initiatives, much as they are to be encouraged, but requires generous long-term government support, comprehensive planning and scrupulous implementation. The recommendations in this paper require major, urgent dedicated programmes in all affected countries. NGOs cannot bear the considerable costs and responsibilities alone. It falls to governments, along with CITES, CMS, commercial stakeholders, global and national NGOs, as well as motivated groups and individuals, to take action without delay, but in a coordinated, cooperative manner. Coordination of both national and international conservation and research efforts for each species is essential. Collaboration between neighbours is equally vital, e.g. India and Pakistan over the Great Indian Bustard, India and Nepal over the Bengal Florican, and between various countries over the management of migrant populations of Great Bustard, Little Bustard and Asian Houbara.

In contrast to other more charismatic large birds—raptors, cranes and pheasants—bustards are poor self-advocates. Their natural reclusiveness does nothing to assure them a place in the public estimation of wildlife, and their use of habitats that are particularly difficult to protect against anthropogenic change puts them at an even greater disadvantage. Conservationists must raise the profiles of these species by relentless campaigns advertising their precarious status, appealing for broad public support for their active management, and energetically promoting programmes outlined in this review. Without such programmes the probability that Great Bustard (nominate race), Little Bustard and Asian Houbara will survive in this region is low; and the probability that Great Bustard (race *dybowskii*), Great Indian Bustard, Bengal Florican and Lesser Florican will survive at all is zero.

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REFERENCES

Abdusalyamov, I. A. (1971) ['*Fauna of the Tajik SSR: birds*.'] Dushanbe: Academy of Sciences of the Tajik SSR. (In Russian.)

Aksakov, S. T. (1852) ['*Notes of a provincial wildfowler*.'] Moscow: Stepanov Publishing. (In Russian.)

Alekseev, A. F. (1985) The Houbara Bustard in the north-west Kyzylkum [USSR]. *Bustard Studies* 3: 87–92. (Translated from *Zool. Zhurn.* 59 [1980]: 1263–1266.)

Al Kharusi, Y. H. & Al Ameri, H. H. (2011) Falconry in the Middle East: an assessment of falconers' ecological knowledge on Asian Houbara *Chlamaydotis* [*sic*] *macqueenii*. *Falco* 30: 4–6.

Allinson, T. (2014) Review of the global conservation status of the Asian Houbara Bustard *Chlamydotis macqueenii*. Report to the Convention on Migratory Species Office – Abu Dhabi. Cambridge: BirdLife International.

Alonso, J. C., Martín, C. A., Alonso, J. A., Palacín, C., Magaña, M. & Lane, S. J. (2004) Distribution dynamics of a great bustard metapopulation throughout a decade: influence of conspecific attraction and recruitment. *Biodivers. & Conserv.* 13: 1659–1674.

Alonso, J. C., Palacín, C., Alonso, J. A. & Martín, C. A. (2009) Post-breeding migration in male great bustards: low tolerance of the heaviest Palaearctic bird to summer heat. *Behav. Ecol. Sociobiol.* 63: 1705–1715.

Alonso, J. C. & Palacín, C. (2010) The world status and population trends of the Great Bustard (*Otis tarda*): 2010 update. *Chinese Birds* 1(2): 141–147.

Andrews, R. C. (1921) *Across Mongolian plains*. New York: Appleton.

Andrews, R. C. (1932) *New conquest of Central Asia*. New York: American Museum of Natural History.

Anonymous (2015a) https://tribune.com.pk/story/931050/protecting-the-houbara-bustard/

Anonymous (2015b) http://www.lifeesteparias.lpn.pt/Project/Project-Sites/Castro-Verde-SPA/Content.aspx?tabid=2358&code=en.

Antonchikov, A. (2011) Little Bustard: current status and conservation prospects. *Steppe Bull.* 31: 33-38. (In Russian.)

Archimaeva, T. P., Zabelin, V. I. & Goreva, N. A. (2013) ['Conservation of the population of the eastern subspecies of Great Bustard and Houbara is a pressing task.'] Pp.121–124 in A. N. Kuksin, N. A. Goreva & A. M. Samdan, eds. ['*Biodiversity of the Altai-Sayan Ecoregion: research and conservation in the protected area network*.'] Kyzyl: Tyvapoligraf. (In Russian.)

Archimaeva, T. P., Zabelin, V. I. & Goreva, N. A. (2015) ['Current status and conservation measures for protection of the Great Bustard *Otis tarda dybowskii* in Tuva (materials for the Red Data Book of Tuva)']. *Bull. Tuva State University, Natural and Agricultural Sciences* 2(25): 74–81. (In Russian.)

Ataev, K., Vasil'ev, V. I., Gorelova, R. I., Karabaev, A. A., Keiklova, A. F., Sopyev, O. & Eminov, A. (1978) ['Materials on the rare and disappearing bird species of Turkmenistan.'] *Bulletin Turkm. SSR Acad. Sci. Biol.* 4: 70–80. (In Russian.)

Azar, J. F., Rautureau, P., Lawrence, M., Calabuig, G. & Hingrat, Y. (2016) Survival of reintroduced Asian Houbara in United Arab Emirates' reserves. *J. Wildlife Mgmt.* 80: 1031–1039.

Bailey, T. A., Samour, J. H. & Bailey, T. C. (1998) Hunted by falcons, protected by falconry: can the houbara bustard (*Chlamydotis undulata macqueenii*) fly into the 21st century? *J. Avian Medicine and Surgery* 12: 190–201.

Bannikov, A. G. & Skalon, V. N. (1948) ['Ornithological remarks on Mongolia.'] *Nature Conserv.* 5: 17–31. (In Russian.)

Baral, H. S., Ram, A. K., Chaudhary, B., Basnet, S., Chaudhary, H., Giri, T. R. & Chaudhary, D. (2012) Conservation status of Bengal Florican *Houbaropsis bengalensis bengalensis* (Gmelin, 1789) (Gruiformes: Otididae) in Koshi Tappu Wildlife Reserve and adjoining areas, eastern Nepal. *J. Threatened Taxa* 4(3): 2464–2469.

Baral, H. S., Ram, A. K., Chaudhary, B., Chaudhary, D., Timsina, A., Acharya, S., Bidari, K., Acharya, S., Acharya, B., Thulung, P., Karki, A. & Acharya, K. P. (2013) Survey of Bengal Florican *Houbaropsis bengalensis bengalensis* (Gmelin, 1789) (Gruiformes: Otididae) in the Koshi Tappu Wildlife Reserve and adjoining areas, Nepal. *J. Threatened Taxa* 5(7): 4076–4083.

Barati, A., Abdulkarimi, R. & Alonso, J. C. (2015) Recent status and population decline of the Great Bustard *Otis tarda* in Iran. *Bird Conserv. Internatn.* 25: 377–384.

Batbayar, N., Batsukh, B., Stacey, J. & Bräunlich, A. (2011) Key endangered species in Galba Gobi: status and provisional impact assessments of regional development scenarios. Ulaanbaatar: unpublished report funded by World Bank and BirdLife International.

Batsaikhan, N. (2002) ['*Conservation strategy for Great Bustard populations in Mongolia*.'] Ulaanbaatar: University of Mongolia. (In Mongolian.)

Batsaikhan, N., Bold, A. & Dorjderem, S. (2005) [Distribution range of the Houbara Bustard (*Chlamydotis undulata macqueenii* Gray, 1832) in Mongolia.] *Birds, amphibians, and reptiles of Mongolia*, 2: 105–115. (In Mongolian.)

Beme, R. L., Grachev, N. P., Isakov, U. A., Koshelev, A. I., Kurochkin, E. N., Potapov, R. L., Rustamov, A. K. & Flint, V. E. (1987) *Birds of USSR. Volume 2: Galliformes, Gruiformes*. Leningrad: Nauka. (In Russian.)

Berezovikov, N. N. (2011) Issues in conservation of wintering Great Bustards in Kazakhstan. Pp.192–194 in *Zoological research during 20 years of independence of the Republic of Kazakhstan*. Almaty [no publisher or editor given]. (In Russian.)

Berezovikov, N. N. (2016) ['Problems in the conservation of wintering Great Bustards in Kazakhstan.'] *Russian Orn. J.* 25: 4506–4509. (In Russian.)

Berezovikov, N. N. & Anisimov, E. A. (2002) New data on Little Bustard (*Tetrax tetrax*) in Alakol Depression. *Kazakhstan Orn. Bull.* 2002: 78. (In Russian.)

Berezovikov, N. N. & Filimonov, A. N. (2017) ['Overwintering of the Great Bustard *Otis tarda* in the western portion of the Alakol depression in 2016–2017']. *Russian Orn. J.* 26: 4426–4427. (In Russian.)

Berezovikov, N. N. & Levinskii, Y. P. (2010) ['Extreme wintering of Great Bustard in Alakol depression in winter 2009/2010']. *Russian Orn. J.* 19: 729–733 (In Russian.)

Berezovikov, N. N. & Levinskii, Y. P. (2012) ['Overwintering of the Great Bustard in the Alakol depression from 2011–2012.'] *Russian Orn. J.* 21: 1153–1155. (In Russian.)

Bhardwaj, G. S., Sivakumar, K. & Jhala, Y. V. (2011) Status, distribution and conservation perspectives of Lesser Florican in the north-western India: a survey report. Dehradun: Wildlife Institute of India (unpublished).

Bhardwaj, G. S., Anoop, K. R., Sharma, P. & Kumar, S. (2017) Role of herbaceous vegetation in habitat utilization by Critically Endangered Great Indian Bustard *Ardeotis nigriceps* (Vigors) in the Indian Thar Desert. *Indian Forester* 143: 975–984.

BirdLife Asia (2009) *Safeguarding important areas of natural habitat in Mongolia alongside economic development*. Ulaanbaatar: East Asia and Pacific Region Sustainable Development Department, World Bank.

BirdLife International (2001) *Threatened birds of Asia: the BirdLife International Red Data Book*. (Third edition, part 3). Cambridge UK: BirdLife International.

BirdLife International (2017) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 15/12/2017.

Bold, A. (2003) Mongolian birds. Pp.143–171 in D. Badarch, R. A. Zilinskas, P. J. Balint, eds. *Mongolia today: science, culture, environment and development*. London: RoutledgeCurzon.

Boldbaatar, S. (2006) ['Fauna of the Shaamar region and its meadow.'] Pp.49–68 in T. K. Dorzhiev, ed. *Siberian ornithology*, 4. Ulan-Ude: Buryat University. (In Russian.)

Brahma, N. & Lahkar, B. P. (2009) Preliminary survey of the Bengal Florican *Houbaropsis bengalensis* in four protected areas of north bank landscape, Assam. *Newsletter & J. Rhino Fdn. for Nature in NE India* 8: 45–47.

Bretagnolle, V., Villiers, A., Denonfoux, L., Cornulier, T., Inchausti, P. & Badenhausser, I. (2011) Rapid recovery of a depleted population of Little Bustards *Tetrax tetrax* following provision of alfalfa through an agri-environment scheme. *Ibis* 153: 4–13.

Burnside, R. J., Collar, N. J., Koshkin, M. A. & Dolman, P. M. (2015) Avian powerline mortalities, including Asian Houbara *Chlamydotis macqueenii*, on the Central Asian flyway in Uzbekistan. *Sandgrouse* 37: 161–168.

Burnside, R. J., Collar, N. J., Scotland, K. M. & Dolman, P. M. (2016) Survival rates of captive-bred Asian Houbara *Chlamydotis macqueenii* in a hunted migratory population. *Ibis* 158: 353–361.

Burnside, R. J., Collar, N. J. & Dolman, P. M. (2017) Comparative migration strategies of wild adult, wild juvenile and captive-bred Asian Houbara *Chlamydotis macqueenii*. *Ibis* 159: 374–389.

Chan, S. & Goroshko, O. (1998) *Action plan for conservation of the Great Bustard*. Tokyo: Asia Council of BirdLife International.

Cheng T., He B., Cheng X. & Wang B. (2011) ['Causes to the injury of great bustard.'] *Shaanxi For. Sci. Technol.* 6: 51–53. (In Chinese.)

Chernobai, V. F., Antonchikov, A. N., Mazina, O. V., Sokhina, J. N. & Makhin, P. I. (2011) ['*Conservation and recovery of the Great Bustard in Volgograd Oblast'*.'] Volgograd: Kruton. (In Russian.)

China Biodiversity Conservation and Green Development Foundation (2017) Bird guards (video). https://www.youtube.com/watch?v=Okc7q2FDyPo.

Collar, N. J. (1980) The world status of the Houbara: a preliminary review. Unpaginated in C. L. Coles & N. J. Collar, eds. *Symposium papers on Great Bustard [and] Houbara Bustard*. Fordingbridge UK: Game Conservancy.

Collar, N. J. (1985) The world status of the Great Bustard. *Bustard Studies* 2: 1–20.

Collar, N. J. (1996) Family Otididae (bustards). Pp.240–273 in J. del Hoyo, A. Elliott & J. Sargatal, eds. *Handbook of the birds of the world*, 3. Barcelona: Lynx Edicions.

Collar, N. J. & Andrew, P. (1988) *Birds to watch: the ICBP world list of threatened birds*. Cambridge UK: International Council for Bird Preservation (Techn. Publ. 8).

Collar, N. J. & Goriup, P. D. (1980) The conservation of the Great Bustard in Portugal: a working report. Oxford: ICBP Bustard Group, unpublished.

Collar, N. J., Dolman, P. M., Scotland, K. M. & Swash, A. R. H. (2014) *The houbara in Uzbekistan*. Abu Dhabi: Emirates Bird Breeding Center for Conservation.

Collar, N. J., Patil, P. S. & Bhardwaj, G. S. (2015) What can save the Great Indian Bustard? *BirdingASIA* 23: 15–24.

Colls, S. (2004) *Ghost wars: the secret history of the CIA, Afghanistan, and Bin Laden, from the Soviet invasion to September 10, 2001*. New York: Penguin Press.

Combreau, O., Launay, F. & Lawrence, M. (2001) An assessment of annual mortality rates in adult-sized houbara bustards (*Chlamydotis [undulata] macqueenii*). *Anim. Conserv.* 4: 133–141.

Combreau, O., Qiao J., Lawrence, M., Gao X., Yao J., Yang W. & Launay, F. (2002) Breeding success in a Houbara Bustard *Chlamydotis [undulata] macqueenii* population on the eastern fringe of the Jungar Basin, People's Republic of China. *Ibis* 144 (on-line): E45-E56.

Combreau, O., Tourenq, C. & Lawrence, M. (2003) Low breeding success in Houbara Bustard (*Chlamydotis [undulata] macqueenii*) does not allow current hunting yield. Pp.57–59 in F. T. Scullion & T. A. Bailey, compilers. *Proceedings of the World Association of Wildlife Veterinarians Wildlife Sessions (27th World Veterinary Congress, Tunisia, 2002)*. Ballygawley, Northern Ireland: World Association of Wildlife Veterinarians.

Combreau, O., Riou, S., Judas, J., Lawrence, M. & Launay, F. (2011) Migratory pathways and connectivity in Asian Houbara Bustards: evidence from 15 years of satellite tracking. *PLoS ONE* 6(6): e20570.

Conservation International (2003) Critical Ecosystem Partnership Fund Caucasus biodiversity hotspot: ecosystem profile. Downloaded from: https://www.cepf.net/our-work/biodiversity-hotspots/caucasus.

Cornwallis, L. (1983) A review of the bustard situation in Iran. Pp.81–88 in P. D. Goriup & H. Vardhan, eds. *Bustards in decline*. Jaipur: Tourism and Wildlife Society of India.

Dasgupta, S. (2017) https://news.mongabay.com/2017/12/video-power-lines-killing-the-last-remaining-great-indian-bustards-in-india/.

Dashnyam, B., Batsaikhan, N. & Kessler, M. (2014) ['Great bustard habitat selection and diet.'] *Great Bustard* 1: 8–13. (In Mongolian.)

Dashnyam, B., Purevsuren, T., Amarsaikhan, S., Bataa, D., Buuveibaatar, B. & Dutson, G. (2016) Malfunction rates of bird flight diverters on powerlines in the Mongolian Gobi. *Mongolian J. Biol. Sci.* 14: 13–20.

Debelo, P. V., Shevchenko, V. L., Sarsengaliev, K. A. & Peshkov, S. M. (1986) ['Bustard family.'] Pp.68–74 in E. V. Gvozdev, ed. ['*Rare animals of Kazakhstan*.'] Alma-Ata: Science. (In Russian.)

Delgado, A. & Moreira, F. (2010) Between-year variations in Little Bustard *Tetrax tetrax* population densities are influenced by agricultural intensification and rainfall. *Ibis* 152: 633–642.

Dement'ev, G. P. (1952) '*Birds of Turkmenistan*.' Ashgabat: Academy of Sciences of Turkmen SSR. (In Russian.)

Dement'ev, G. P. & Gladkov, N. A., eds. (1951) *Birds of the Soviet Union*, 2. Moscow: Sovetskaja Nauka. (In Russian.)

Ding C. & He F. (2009) *Otis tarda* Linnaeus, 1758. Pp.236–237 in S. Wang, Y. Xie, eds. *China Species Red List, II: Vertebrates*. Part 2. Beijing: Higher Education Press.

DNPWC (2016) *Bengal Florican conservation action plan*. Kathmandu: Department of National Parks and Wildlife Conservation.

Doherty, T. S., Dickman, C. R., Glen, A. S., Newsome, T. M., Nimmo, D. G., Ritchie, E. G., Vanak, A. T. & Wirsing, A. J. (2017) The global impacts of domestic dogs on threatened vertebrates. *Biol. Conserv.* 210: 56–59.

Dolman, P. M., Scotland, K. M., Collar, N. J. & Burnside, R. J. (2015) Ark or park: the need to predict relative effectiveness of *ex situ* and *in situ* conservation before attempting captive breeding. *J. Appl. Ecol.* 52: 841–850.

Dolman, P. M., Collar, N. J. & Burnside, R. J. (submitted) Demographic modelling parameterised by fieldwork and satellite telemetry predicts extinction of migratory Asian Houbara *Chlamydotis macqueenii* without hunting controls. *Biol. Conserv.*

Donald, P. F. (2007) Adult sex ratios in wild bird populations. *Ibis* 149: 671–692.

Donald, P. F., Collar, N. J., Marsden, S. J. & Pain, D. J. (2013) *Facing extinction: the world's rarest birds and the race to save them*. Second edition. London: T. & A. D. Poyser.

Dutta, S. (2012) Factors influencing distribution and density of a breeding population of the endangered lesser florican *Sypheotides indica* in an agro-pastoral landscape. In Y. Jhala, A. R. Rahmani & S. Sankaran, eds. *Research and conservation of endangered and threatened fauna of Kachchh: an integrated approach, 2004–2011*. Dehradun: Wildlife Institute of India.

Dutta, S. (2018) Bustard, wires, and the flight to extinction. www.conservationindia.org/ articles/bustard-wires-and-the-flight-to-extinction.

Dutta, S. & Jhala, Y. (2014) Planning agriculture based on landuse responses of threatened semiarid grassland species in India. *Biol. Conserv.* 175: 129–139.

Dutta, S., Rahmani, A. R. & Jhala, Y. V. (2011) Running out of time? The great Indian bustard *Ardeotis nigriceps*—status, viability, and conservation strategies. *Eur. J. Wildl. Res.* 57: 615–625.

Dutta, S., Rahmani, A. R., Gautam, P., Kasambe, R., Narwade, S., Narayan, G. & Jhala, Y. V. (2013) *Guidelines for state action plan for resident bustards' recovery programme*. New Delhi: Ministry of Environment and Forests, Government of India.

Dutta, S., Bhardwaj, G. S., Bhardwaj, D. K. & Jhala, Y. V. (2014) Status of Great Indian Bustard and associated wildlife in Thar. Dehradun: Wildlife Institute of India; Jaipur: Rajasthan Forest Department (unpublished report).

Dutta, S., Bipin, C. M., Bhardwaj, G. S., Anoop, K. R. & Jhala, Y. V. (2016) Status of Great Indian Bustard and associated wildlife in Thar. Dehradun: Wildlife Institute of India; Jaipur: Rajasthan Forest Department (unpublished report).

Dutta, S., Narwade, S., Bipin, C. M., Gadhavi, D., Uddin, M., Mhaskar, M., Pandey, D., Mohan, A., Sharma, H., Iyer, S., Tripathi, R., Verma, V., Varma, V., Chakdar, B., Karulkar, A., Lambutre, B., Khongsai, N., Kumar, S., Gore, K., Jhala, D., Vaidya, N., Horne, B., Chittora, A., Annigeri, B. S., Trivedi, M. & Jhala, Y. V. (2018) Status of the lesser florican *Sypheotides indicus* and implications for its conservation. Dehradun: Wildlife Institute of India.

Elaev, J. N. (2013) ['Great bustard.'] P.173 in ['*Red Book of the Republic of Buryatia*.'] Ulan-Ude: Ministry of Natural Resources of the Republic of Buryatia. (In Russian.)

Erdenee, B. (2011) Mapping and monitoring of cropland area in Mongolia by remote sensing and GIS. PhD thesis, Graduate School of Science and Technology, Chiba University, Japan.

Estrada, A., Delgado, M. P., Arroyo, B., Traba, J. & Morales, M. B. (2016) Forecasting large scale habitat suitability of European bustards under climate change: the role of environmental and geographic variables. *PLoS ONE* 11(3): e0149810.

Faria, N. & Morales, M. B. (2018) Population productivity and late breeding habitat selection by the threatened little bustard: the importance of grassland management. *Bird Conserv. Internatn.* doi:10.1017/S0959270917000387.

Faria, N., Rabaça, J. E. & Morales, M. B. (2012) The importance of grazing regime in the provision of breeding habitat for grassland birds: the case of the endangered little bustard (*Tetrax tetrax*). *J. Nature Conserv.* 20: 211–218.

Faria, N., Morales, M. B. & Rabaça, J. E. (2016) Exploring nest destruction and bird mortality in mown Mediterranean dry grasslands: an increasing threat to grassland bird conservation. *European J. Wildlife Res.* 62: 663–67.

Federal Governmental Budget Office of Russia (2018) Online database: ['*Special Protected Natural Areas of Russia: Red Books*.'] http://oopt.aari.ru/rbdata. Accessed 02/01/2018. (In Russian.)

Fedosov, V. N., Fedosov, A. V. & Antonchikov, A. N. (2017) Surveys of Little Bustard in Orenburg Province and species conservation prospects. *Steppe Bull.* 49: 55–58. (In Russian.)

Gadhavi, D., Gore, K. & Bargali, H. S. (2012) The last call to save Indian Bustard in Kutch, Gujarat, India. Corbett Foundation, India, technical report to Government of Gujarat.

Gadhvi, I. R. (2003) Monitoring nesting sites of Lesser Floricans (*Sypheotides indica*) in and around Blackbuck National Park, Gujarat. *Zoos' Print J.* 18: 1135–1142.

Gao F., Yan Y. & Sun X. N. (2009) [Injury and rescue analysis of Great Bustard distributed in Beijing.] *Forestry Technology of Hebei* 5: 37–38. (In Chinese.)

Gao X. Y., Dai K. & Xu K. F. (1994) [Preliminary survey of bustard in northern Xinjiang.] *Chinese J. Zool.* 2: 52–53. (In Chinese with English summary.)

Gao X. Y., Yang W. K., Qiao J. F., Yao J. & Xu K. F. (2007) ['Distribution and status of bustards in China.'] *Arid Zone Res*. 24(2): 179–185. (In Chinese.)

Gao X., Yang W., Qiao J., Yao J. & Xu K. (2008) Distribution and status of bustards in China. *Frontiers of Biology in China* 3: 385–391.

García de la Morena, E. L., Bota, G., Mañosa, S. & Morales, M. B. (2017) II censo nacional de sisón común: el dramático declive del bastión europeo de la especie. Pp.4–11 in Programas de Seguimiento y Grupos de Trabajo de SEO/BirdLife 2016. Madrid: SEO/BirdLife.

García-del-Rey, E. & Rodriguez-Lorenzo, J. A. (2011) Avian mortality due to power lines in the Canary Islands with special reference to the steppe-land birds. *J. Nat. Hist.* 45: 2159–2169.

Gauger, K. (2007) Occurrence, ecology and conservation of wintering Little Bustards *Tetrax tetrax* in Azerbaijan. *Archiv f. Natursch. u. Landschaftsfor.* 46: 5–27.

Gavlyuk, J. V. & Yudichev, E. N. (1998) ['Great bustard.'] Pp.51–52 in ['*Red Book of Orenburg Province*']. Orenburg, Russia: Orenburg Publishing.

Gavrin, V. F. (1962) ['Bustards.'] Pp.5–38 in V. F. Gavrin, I. A. Dolgushin, M. N. Korelev & M. A. Kuz'mina, eds. ['*Birds of Kazakhstan*.'] Alma-Ata: Academy of Science of the Kazakh SSR. (In Russian.)

Gombobaatar, S. & Monks, E. M., compilers (2011) *Mongolian red list for birds*. London: Zoological Society of London; Ulaanbaatar: Mongolian Ornithological Society and National University of Mongolia.

Goriup, P. D. (1997) The world status of the Houbara Bustard *Chlamydotis undulata*. *Bird Conserv. Internatn.* 7: 373–397.

Goriup, P. D. & Vardhan, H. (1983) *Bustards in decline*. Jaipur: Tourism and Wildlife Society of India.

Goroshko O. A. (2000) ['Current status of the eastern subspecies of the Great Bustard and issues related to its conservation.'] Pp.15–22 in A. V. Khrustov, ed. ['*Bustard species of Russia and adjacent countries: a collection of scientific research*.']. Saratov: Saratov University. (In Russian.)

Goroshko, O. A. (2002) Status and conservation of populations of cranes and bustards in south-eastern Trans-Baikal Region and north-eastern Mongolia. PhD, All-Russian Institute for Nature Protection, Moscow, Russia. (In Russian.)

Goroshko, O. A. (2003) ['Influence of multi-year climate cycles on populations of the eastern subspecies of great bustard.'] Pp.7–29 in A. V. Khrustov, ed. ['*Bustards of Russia and adjacent countries*, 2.'] Saratov: Saratov University. (In Russian.)

Goroshko, O. A. (2008) ['Biological data on the eastern subspecies of Great Bustard (*Otis tarda dybowskii*) in Dauria.'] Pp.130–142 in V. V. Spitsin, ed. ['*Bustards of the Palearctic: breeding and conservation*.'] Moscow: Moscow Zoo. (In Russian.)

Goroshko, O. A. (2012) ['Great bustard.'] Pp.128–130 in E. V. Vishnyakov, A. N. Tarabarko & V. E. Kiriklyuk, eds. ['*Red Book of Zabaikal'skii Krai*.'] Novosibirsk: Novosibirsk Publishing. (In Russian.)

Goroshko, O. A. (in press) Great Bustard population in eastern Transbaikalia: status, dynamics, biology, threats, conservation. In A. E. Kessler, ed. *Proceedings of conference 'Advancing the Conservation of the Great Bustard in Asia' (Ulaanbaatar, Mongolia, 25–26 May 2017)*.

Goroshko, O. A. & Andronov, V. A. (2009) ['Great bustard.'] Pp.112–113 in O. H. Kozhemyako, ed. ['*Red Book of Amur Oblast*'.'] Blagoveshchensk: BGPU Publishers. (In Russian.)

Gortázar, C., Villafuerte, R. & Martín, M. (2000) Success of traditional restocking of Red-legged Partridge for hunting purposes in areas of low density of northeast Spain Aragón [*sic*]. *Z. Jagdwiss.* 46: 23–30.

Goswami, B. N., Venugopal, V., Sengupta, D., Madhusoodanan, M. S. & Xavier, P. K. (2006) Increasing trend of extreme rain events over India in a warming environment. *Science* 314: 1442–1445.

Gray, T. N. E., Hong Chamnan, Ro Borey, Collar, N. J. & Dolman, P. M. (2007) Habitat preferences of a globally threatened bustard provide support for community-based conservation in Cambodia. *Biol. Conserv.* 138: 341–350.

Gray, T. N. E., Collar, N. J., Davidson, P. J. A., Dolman, P. M., Evans, T. D., Fox, H. N., Hong Chamnan, Ro Borey, Seng Kim Hout & van Zalinge, R. N. (2009a) Distribution, status and conservation of Bengal Florican *Houbaropsis bengalensis* in Cambodia. *Bird Conserv. Internatn.* 19: 1–14.

Gray, T. N. E., Tarrant, M., Hong Chamnan, Collar, N. J. & Dolman, P. M. (2009b) Sex-specific habitat use by a lekking bustard: conservation implications for the Critically Endangered Bengal Florican (*Houbaropsis bengalensis*) in an intensifying agroecosystem. *Auk* 126: 112–122.

Gubin, B. (1992) Numbers, distribution and state of protection of the Houbara Bustard in the south of Kazakhstan. *Bustard Studies* 5: 98–103.

Gubin, B. M. (2007) ['Great bustard.'] Pp.387–391 in A. K. Rustamov & A. F. Kovshar', eds. ['*Birds of Central Asia*, 1.'] Almaty: Bird Protection Society of Kazakhstan. (In Russian.)

Gubin, B. (2008) *A natural history of the Houbara Bustard*. Abu Dhabi: Environment Agency.

Gubin, B. M. & Karpov, F. F. (1999) Data on breeding birds of Biylikul Lake (Southern Kazakhstan). *Russian Orn. J.* 8(75): 3–13. (In Russian.)

Guerrero, I., Morales, M. B., Oñate, J. J., Geiger, F., Berendse, F., de Snoo, G., Eggers, S., Pärt, T., Bengtsson, J., Clement, L. W., Weisser, W. W., Olszewski, A., Ceryngier, P., Hawro, V., Liira, J., Dennis, C., Emmerson, M., Fischer, C., Flohre, A., Thies, C. & Tscharntke, T. (2012) Response of ground-nesting farmland birds to agricultural intensification across Europe: landscape versus field level management factors. *Biol. Conserv.* 152: 74–80.

Habib, B., Talukdar, G., Kumar, R. S., Nigam, P., Limaye, S. & Vaijayanti, V. (2016) Tracking the Great Indian Bustard in Maharashtra, India. Dehradun: Wildlife Institute of India; Nagpur: Maharashtra Forest Department.

Hillard, R. (2012) Non-breeding habitat requirements and conservation threats to the Bengal florican (*Houbaropsis bengalensis*) in Cambodia. MSc dissertation, University of East Anglia, Norwich, UK.

Hingrat, Y., Saint Jalme, M., Ysnel, F., Le Nuz, E. & Lacroix, F. (2007) Habitat use and mating system of the houbara bustard (*Chlamydotis undulata undulata*) in a semi-desertic area of North Africa: implications for conservation. *J. Orn.* 148: 39–52.

Home, C., Bhatnagar, Y. V. & Vanak, A. T. (2017) Canine conundrum: domestic dogs as an invasive species and their impacts on wildlife in India. *Animal Conservation*. DOI: 10.1111/acv.12389.

del Hoyo, J. & Collar, N. J. (2014) *The HBW & BirdLife International illustrated checklist of the birds of the world, 1: non-passerines*. Barcelona: Lynx Edicions.

Ibbett, H., Chansetha, L., Phlai, P., Song, D., Hong, C., Mahood, S. P. & Milner-Gulland, E. J. (2017) Conserving a globally threatened species in a semi-natural, agrarian landscape. *Oryx:* doi.org/10.1017/S003060531600708.

Im, E. S., Pal, J. S. & Eltahir, E. A. (2017) Deadly heat waves projected in the densely populated agricultural regions of South Asia. *Science Advances* 3(8): e1603322.

Inchausti, P. & Bretagnolle, V. (2005) Predicting short-term extinction risk for the declining Little Bustard (*Tetrax tetrax*) in intensive agricultural habitats. *Biol. Conserv.* 122: 375–384.

Iñigo, A. & Barov, B. (2010) *Action plan for the Little Bustard Tetrax tetrax in the European Union*. Madrid: SEO|BirdLife and BirdLife International for the European Commission.

Inskipp, C., Baral, H. S., Phuyal, S., Bhatt, T. R., Khatiwada, M., Inskipp, T., Khatiwada, A., Gurung, S., Singh, P. B., Murray, L., Poudyal, L. & Amin, R. (2016). *The status of Nepal's birds: the national red list series*. Downloaded from https://www.zsl.org/conservation/regions/asia/national-red-list-of-nepals-birds.

Irisova, N. L. & Kotlov, A. A. (2016) ['Little Bustard – *Tetrax tetrax*.'] Pp.195–196 in *Red Book of Altai Krai*, 2. Barnaul: Altai University. (In Russian.)

Isakov, Y. A. (1982) Status of Great Bustard and Little Bustard populations in the USSR and perspectives on their conservations [*sic*]. Pp.322–324 in V. D. Ilyichev & V. M. Gavrilov, eds. *XVIII Congressus Internationalis Ornithologicus, Moscow, 1982 (Abstracts of symposia and poster presentations)*. Moscow: Nauka.

Isakov, Y. A. & Vorob'ev, K. A. (1940) ['An overview of wintering spots and migration of birds on the southern Caspian.'] *Works Natl. Orn. Prot. Area Gassan-Kuli* 1: 103–104. (In Russian.)

Ishtiaq, F., Dutta, S., Yumnan, B. & Jhala, Y. V. (2011) Low genetic diversity in the endangered great Indian bustard (*Ardeotis nigriceps*) across India and implications for conservation. *Conserv. Genet.* 12: 857–863.

Islam, M. Z. U. & Rahmani, A. R. (2011) Thar Desert, Rajasthan, India: anthropogenic influence on biodiversity and grasslands. *Biodiversity* 12(2): 75–89.

Jha, R. R. S., Thakuri, J. J., Rahmani, A. R., Dhakal, M., Khongsai, N., Pradhan, N. M. B., Shinde, N., Chauhan, B. K., Talegaonkar, R. K., Barber, I. P., Buchanan, G. M., Galligan, T. H. & Donald, P. F. (2018) Distribution, movements and survival of the critically endangered Bengal Florican *Houbaropsis bengalensis* in India and Nepal. *Oryx* doi.org/10.1007/s10336-018-1552-1.

Jiang J. (2004) ['The status of resource and conservation of Great Bustard in China.'] PhD Dissertation. Harbin: Northeast Forestry University. (In Chinese.)

Jiang Z. & 37 co-authors (2016) ['Red list of China's vertebrates.'] *Biodiversity Science* 24: 500–551. (In Chinese.)

Jiguet, F. & Bretagnolle, V. (2006) Manipulating lek size and composition using decoys: an experimental investigation of lek evolution models. *Amer. Nat.* 168: 758–768.

Jolivet, C. & Bretagnolle, V. (2002) L'outarde canepetière en France : évolution récente des populations, bilan des mesures de sauvegarde et perspectives d'avenir. *Alauda* 70: 93–96.

Judas, J., Ding C. Q., Lu J., Noir, S., Sadoul, N. & Yang W. (2005) Estimating abundance and population trends with special references to the propagation and reintroduction of the Asian Houbara (*Chlamydotis macqueenii*) in the Xinjiang Province, People's Republic of China. Abu Dhabi: Environment Agency Mission Report—NARC-SFA Survey.

Judas, J., Combreau, O., Lawrence, M., Saleh, M., Launay, F. & Gao X. (2006) Migration and range use of Asian Houbara Bustard *Chlamydotis macqueenii* breeding in the Gobi Desert, China, revealed by satellite tracking. *Ibis* 148: 343–351.

Kamp, J., Sheldon, R., Koshkin, M. A., Donald, P. F. & Biedermann, R. (2009) Post-Soviet steppe management causes pronounced synanthropy in the globally threatened Sociable Lapwing *Vanellus gregarius*. *Ibis* 151: 452–463.

Kamp, J., Urazaliev, R., Donald, P. F. & Hölzel, N. (2011) Post-Soviet agricultural change predicts future declines after recent recovery in Eurasian steppe bird populations. *Biol. Conserv.* 144: 2607–2614.

Kamp, J., Urazaliev, R., Balmford, A., Donald, P. F., Green, R. E., Lamb, A. J. & Phalan, B. (2015) Agricultural development and the conservation of avian biodiversity on the Eurasian steppes: a comparison of land-sparing and land-sharing approaches. *J. Appl. Ecol.* 52: 1578–1587.

Kasybekov, J. S. (2006) ['Great Bustard'] Pp.430–431 in ['*Red Data Book of Kyrgyz Republic*.'] Bishkek: Government of Kyrgyz Republic. (In Kyrgyz and Russian, with English abstract.)

Kel'berg, G. V. & Smirnov, M. N. (1988) Pp.110–112 in Y. G. Shvetsov, ed. ['*Rare terrestrial vertebrates of Siberia*.'] Novosibirsk: Science-Siberia. (In Russian.)

Kessler, A. E. (2015) Asian Great Bustards: from conservation biology to sustainable grassland development. PhD thesis, Arizona State University, Tempe, USA.

Kessler, A. & Smith, A. T. (2014) The status of the Great Bustard (*Otis tarda tarda*) in Central Asia: from the Caspian Sea to the Altai. *Aquila* 121: 115–132.

Kessler, A. E., Batbayar, N., Natsagdorj, T., Batsuur', D. & Smith, A. T. (2013) Satellite telemetry reveals long-distance migration in the Asian great bustard *Otis tarda dybowskii*. *J. Avian Biol.* 44: 311–320.

Kessler, A. E., Nyambayar, B. & Natsagdorj, T. (2016) ['Status of Great Bustards in Uvs Aimag, Mongolia.'] Ulaanbaatar: Report to Uvs Aimag Administration. (In Mongolian.)

Kessler, A., Santos, M., Flatz, R., Batbayar, N., Natsagdorj, T., Batsuur', D., Bidashko, F., Galbadrakh, N., Goroshko, O., Khrokov, V., Unenbat, T., Vagner, I., Wang, M. & Smith, A. C. (in revision) Mitochondrial divergence between western and eastern Great Bustards: implications for conservation and species status. *J. Heredity*.

Khadka, B. B., Subedi, H. & Chaudhary, D. B. (2013) Current status of Bengal Florican in Chitwan National Park, Nepal. *Ibisbill* 2: 81–86.

Khan, A. A., Khaliq, I., Choudhry, M. J. I., Farooq, A. & Hussain, N. (2008) Status, threats and conservation of the Great Indian Bustard *Ardeotis nigriceps* (Vigors) in Pakistan. *Current Science* 95: 1079–1082.

Khan, A. S. (2016a) Supreme Court lifts hunting ban on rare houbara bustard. https://www.dawn.com/news/1234663.

Khan, M. I. (2016b) Pakistan's secretive Houbara bustard hunting industry. http://www.bbc.co.uk/news/world-asia-35524916.

Korovin, V. A. (2014) Restoration of the Little Bustard population in the northern steppe Trans Urals. *Biology Bull. (Russian Acad. Sci.)* 41: 856–851.

Koshkin, M. A. (2011) Habitat preferences of steppe breeding birds in Central Kazakhstan, in relation to different forms of land use. MSc dissertation, University of East Anglia, UK.

Koshkin, M. A., Collar, N. J. & Dolman, P. M. (2014) Do sheep affect distribution and habitat of Asian Houbara *Chlamydotis macqueenii*? *J. Arid Env.* 103: 53–62.

Koshkin, M. A., Burnside, R. J., Collar, N. J., Guilherme, J. L., Showler, D. A. & Dolman, P. M. (2016a) Effects of habitat and land-use on breeding-season density of male Asian Houbara *Chlamydotis macqueenii*. *J. Orn.* 157: 811–823.

Koshkin, M., Burnside, R. J., Packman, C. E., Collar, N. J. & Dolman, P. M. (2016b) Effects of habitat and livestock on nesting success of the declining Asian Houbara *Chlamydotis macqueenii*. *Eur. J. Wildl. Res*. 62: 447–459.

Kreitsberg-Mukhina, E. A. (2003) ['The current status of bustard species in Uzbekistan.'] Pp.64–75 in A. V. Khrustov, ed. ['*Bustards of Russia and adjacent countries*, Vol. 2.'] Saratov: Saratov Univ. Press. (In Russian.)

Kreitsberg-Mukhina, E. A. (2009) ['Great bustard.'] Pp.164–165 in B. O. Tashmuhamedov, ed. ['*Red Book of Uzbekistan*.'] Tashkent: Chinor ENK. (In Uzbek and Russian.)

Kumar, H. (2012) Terai grasslands—management and conservation perspectives for avian species. Pp.123–131 in A. R. Rahmani (2012) *Threatened birds of India*: *their conservation requirements*. Mumbai: Oxford University Press (for the Indian Bird Conservation Network).

Kumar, H. (2013) Conservation status of Bengal florican *Houbaropsis bengalensis* in Dudwa Tiger Reserve, Uttar Pradesh, India. *Cibtech J. Zool.* 2(1): 61–69.

Kurbonov, S. & Toshev, A. (2015) ['Great Bustard.'] P.172 in ['*Red Book of the Republic of Tajikistan*.'] Dushanbe: Donish. (In Tajik.)

Kurganova, I., Lopes de Gerenyu, V., Six, J. & Kuzyakov, Y. (2013) Carbon cost of collective farming collapse in Russia. *Glob. Chang. Biol.* 20: 938–947.

Lacroix, F., Seabury, J., Al Bowardi, M. & Renaud, J. (2003) The Emirates Center for Wildlife Propagation: comprehensive strategy to secure self-sustaining wild populations of Houbara Bustard (*Chlamydotis undulata*) in eastern Morocco. Pp.60–62 in F. T. Scullion & T. A. Bailey, compilers. *Proceedings of the World Association of Wildlife Veterinarians Wildlife Sessions (27th World Veterinary Congress, Tunisia, 2002).* Ballygawley, Northern Ireland: World Association of Wildlife Veterinarians.

Laikre, L., Schwartz, M. K., Waples, R. S. & Ryman, N. (2010) Compromising genetic diversity in the wild: unmonitored large-scale release of plants and animals. *Trends Ecol. Evol.* 25: 520–529.

Lane, S. J. & Alonso, J. C. (2001) Status and extinction probabilities of great bustard (*Otis tarda*) leks in Andalucía, southern Spain. *Biodiv. & Conserv.* 10: 893–910.

Lane, S. J., Alonso, J. C. & Martín, C. A. (2001) Habitat preferences of great bustard *Otis tarda* flocks in the arable steppes of central Spain: are potentially suitable areas unoccupied? *J. Appl. Ecol.* 38: 193–203.

Lapiedra, O., Ponjoan, A., Gamero, A., Bota, G. & Mañosa, S. (2011) Brood ranging behaviour and breeding success of the threatened little bustard in an intensified cereal farmland area. *Biol. Conserv.* 144: 2882–2890.

Li X.- M., Liu X.- C., Zhou J.- Y., Cheng W. J., Yi G. L. & Wu B. X. (2005) ['Surveys of the Great Bustard in winter in Tumuji, Inner Mongolia, China.'] *Chinese J. Zool.* 40: 46–49. (In Chinese.)

Lin C. (2016) Hunting hunters. In: *Exposure*. https://cicylin.exposure.co/hunting-hunters.

Liu G., Hu X., Shafer, A. B. A., Gong M., Han M., Yu C., Zhou J., Bai J., Meng D., Yu G. & Dang D. (2017) Genetic structure and population history of wintering Asian Great Bustard (*Otis tarda dybowskii*) in China: implications for conservation. *J. Orn.* 158: 761–772.

Liu G., Shafer, A., Hu X., Li L. H., Ning Y., Gong M. H., Cui L. J., Li H. X., Hu D. F., Qi L., Tian H. J. & Wang B. J. (2018) Meta-barcoding insights into the spatio-temporal dietary patterns of the Asian Great Bustard with implications for divergent migratory strategies. *Ecol. & Evol.* 8: 1736–1745.

Liu J., Wu Y. & Xu X. (2013) ['The assistance and conservation of wintering great bustard in Shaanxi Province.'] *Sichuan J. Zool.* 32: 306–307. (In Chinese.)

Lu X. Q. & Tian X. H. (2011) [Time budget of behaviors and activity rhythm of Great Bustard in captive during different breeding periods.] *J. Northeast Forestry Univ.* 39(5): 84–87. (In Chinese.)

Magaña, M., Alonso, J. C., Martín, C. A., Bautista, L. M. & Martín, B. (2010) Nest-site selection by Great Bustards *Otis tarda* suggests a trade-off between concealment and visibility. *Ibis* 152: 77–89.

Magaña, M., Alonso, J. C., Alonso, J. A., Martín, C. A., Martín, B. & Palacín, C. (2011) Great Bustard (*Otis tarda*) nest locations in relation to leks. *J. Orn.* 152: 541–548.

Mahood, S. P., Silva, J. P., Dolman, P. M. & Burnside, R. J. (2018) Proposed power transmission lines in Cambodia constitute a significant new threat to the largest population of the Critically Endangered Bengal florican *Houbaropsis bengalensis*. *Oryx* 52: 147–155.

Manakadan, R. & Rahmani, A. R. (1998) Crop damage by blackbuck at Rollapadu Wildlife Sanctuary, Andhra Pradesh. *J. Bombay Nat. Hist. Soc.* 95: 408–417.

Marcelino, J., Moreira, F., Mañosa, S., Cuscó, F., Morales, M. B., García de la Morena, E. L., Bota, G., Palmeirim, J. M. & Silva, J. P. (2017) Tracking data of the Little Bustard *Tetrax tetrax* in Iberia shows high anthropogenic mortality. *Bird Conserv. Internatn.* doi:10.1017/S095927091700051X.

Martin, G. R. & Shaw, J. M. (2010) Bird collisions with power lines: failing to see the way ahead? *Biol. Conserv.* 143: 2695–2702.

Martin, T. E., Nivet-Mazerolles, V., Landsmann, C., Guilleman, M., Dubos, J., Valejo, F. & Dombrovski, V. (2014) Bird records from south-central Uzbekistan, 2010–2013. *Sandgrouse* 36: 34–49.

Meklenburtsev, R. N. (1953) ['*Fauna of the Uzbek SSR. Vol 2: Birds*, Part 1.'] Tashkent: Academy of Sciences of the Uzbek SSR. (In Russian.)

Meng D. R. (2010) ['Study on the rescue to Great Bustard in Cangzhou, Hebei.'] Pp.22–31 in [*Proceedings of First International Symposium on the Conservation of the Great Bustard in China, Beijing, China*]. Beijing: Beijing Forestry University Press. (In Chinese.)

Menzbir, M. A. (1895) ['*Birds of Russia*.'] Moscow: Kushnerev and Co. (In Russian.)

Mi C., Falk, H. & Guo Y. (2016) Climate change enlarges China's Great Bustards' suitable wintering distribution in the 21st century. *Peer J.* 4: e1630.

Mian, A. (1986) Ecological impact of Arab falconry on Houbara Bustard in Baluchistan. *Env. Conserv.* 13: 41–46.

Mian, A. (1988) A contribution to the biology of the Houbara (*Chlamydotis undulata macqueenii*); some observations on 1983–84 wintering population in Baluchistan. *J. Bombay Nat. Hist. Soc.* 85: 9–25.

Mian, A. & Dasti, A. A. (1985) The Houbara Bustard in Baluchistan, 1982–1983: a preliminary review. *Bustard Studies* 3: 45–49.

Mirza, Z. B. (1985) A note on Houbara Bustards in Cholistan, Punjab. *Bustard Studies* 3: 43–44.

Mitrofanov, O. B. (2007) ['Houbara Bustard.'] Pp.250–251 in N. P. Malkov, ed. *Red Book of Altai Republic—Animals*. Gorno-Altaisk: Gorno-Altaisk Publishing. (In Russian.)

Mityaev, I. D. & Yashchenko, R. V. (2006) ['Great Bustard.'] In: *Red Book of Kazakhstan*. Almaty: Government of Kazakhstan. (In Russian.)

MoEF (2011) Guidelines for declaration of Eco-Sensitive Zones around National Parks and Wildlife Sanctuaries. http://www.moef.gov.in/sites/default/files/1%20Guidelines% 20for%20Eco-Sensitive%20Zones%20around%20Protected%20Areas.pdf.

Morales, M. B., Jiguet, F. & Arroyo, B. (2001) Exploded leks: what bustards can teach us. *Ardeola* 48: 85–98.

Morales, M. B., Bretagnolle, V. & Arroyo, B. (2005) Viability of the endangered little bustard *Tetrax tetrax* population of western France. *Biodivers. & Conserv.* 14: 3135–3150.

Morales, M. B., Traba, J., Carriles, E., Delgado, M. P. & García de la Morena, E. L. (2008) Sexual differences in microhabitat selection of breeding little bustards *Tetrax tetrax*: ecological segregation based on vegetation structure. *Acta Oecologica* 34: 345–353.

Morales, M. B., Traba, J., Delgado, M. P. & García de la Morena, E. L. (2013) The use of fallows by nesting little bustard *Tetrax tetrax* females: implications for conservation in mosaic cereal farmland. *Ardeola* 60: 85–97.

Moreira, F. & Leitão, D. (1996) A preliminary study of the breeding bird community of fallows of cereal steppes in southern Portugal. *Bird Conserv. Internatn.* 6: 255–259.

Moreira, F., Morgado, R. & Arthur, S. (2004) Great bustard *Otis tarda* habitat selection in relation to agricultural use in southern Portugal. *Wildlife Biol.* 10: 251–260.

Moseykin, V. N. (1992) Ecology and protection of the little bustard in the Saratov region. *Bustard Studies* 5: 78–91.

Nadeem, N. S., Asif, M. & Maan, M. A. (2004) Estimation of the Punjab (Pakistan) wintering population of the Houbara Bustard *Chlamydotis macqueenii*. *Acta Orn.* 39: 75–78.

Nadeem, N. S., Maan, M. A., Mahmood, T. & Abbasi, A. I. (2005) Population estimates of Houbara Bustard *Chlamydotis undulata macqueenii* in Punjab, Pakistan, November 1999. *Ardeola* 52: 163–166.

Narwade, S., Dutta, S., Gadhvi, D., Abdul Samad, K. S., Rahmani, A. R. & Manakadan, R. (2015a) Great Indian Bustard—on the brink of extinction. *Buceros* 21(1&2): 1–48.

Narwade, S. S., Hegde, V., Fulzele, V. V., Lalsare, B. T. & Rahmani, A. R. (2015b) Lesser Florican *Sypheotides indica* in Warora (Chandrapur, Maharashtra, India): conservation requirements. *Indian Birds* 10(2): 50–52.

Narwade, S. S., Lambture, B. R. & Rahmani, A. R. (2017) Implementation of the Wildlife Conservation and Monitoring Plan for National Thermal Power Corporation (NTPC), Solapur, in collaboration with Wildlife Division, Pune. Final report submitted by BNHS to NTPC, Solapur, Maharashtra.

Nechaev, V. A. (2005) ['Great bustard.'] Pp.270–271 in ['*Red Book of Primorskii Krai*.'] Vladivostok: Russian Academy of Sciences, Far East Division. (In Russian.)

Nefedov, A. A. (2001) ['Great bustard in Omsk Oblast'.] P.129 in V. K. Ryabitsev, ed. ['*Materials on the distribution of birds in the Urals, Priaral'ya, and Western Siberia*.'] Ekaterinburg: Ekaterinburg Publishing. (In Russian.)

Nefedov, A. A. (2002) ['*Action plan for the conservation of the Great Bustard in Omsk Oblast*.'] Omsk: GUPR-Omsk. (In Russian.)

Nefedov, A. A. (2013a) ['Otididae in Omsk Province.'] *Steppe Bull.* 38: 44–47. (In Russian.)

Nefedov, A. A. (2013b) ['A zapovednik in Kurumbel'skaya steppe?'] *Steppe Bull.* 39: 36–43. (In Russian.)

Oparina, O. S., Oparin, M. L. & Surov, A. V. (2014) The current land use and its impact on the Great Bustard (*Otis tarda*) population in the Saratov province of Russia. *Aquila* 121: 107–113.

Oparina, O. S., Kondratenkov, I. A., Oparin, M. L., Mamaev, A. B. & Trofimova, L. S. (2016) Abundance dynamics of the Trans-Volga great bustard (Otididae, Aves) population. *Biology Bulletin* 43: 1428–1433.

Orubah, S. A. (2016) The legal status of hunting houbara bustards by foreign dignitaries. *LUMS Law J.* 3(1): 51–60.

Packman, C. E. (2011) Seasonal landscape use and conservation of a critically endangered bustard: Bengal florican in Cambodia. PhD thesis, University of East Anglia UK.

Packman, C. E., Gray, T. N. E., Collar, N. J., Evans, T. D., van Zalinge, R. N., Son Virak, Lovett, A. A. & Dolman, P. M. (2013) Rapid loss of Cambodia's grasslands. *Conserv. Biol.* 27: 245–247.

Packman, C. E., Showler, D. A., Collar, N. J., Son Virak, Mahood, S. P., Handschuh, M., Evans, T. D., Hong Chamnan & Dolman, P. M. (2014)

Rapid decline of the largest remaining population of Bengal Florican *Houbaropsis bengalensis* and recommendations for its conservation. *Bird Conserv. Internatn.* 24: 429–437.

Palacín, C. & Alonso, J. C. (2008) An updated estimate of the world status and population trends of the great bustard *Otis tarda*. *Ardeola* 55: 13–25.

Palacín, C., Alonso, J. C., Alonso, J. A., Martín, C. A., Magaña, M. & Martín, B. (2009) Differential migration by sex in the Great Bustard: possible consequences of an extreme sexual size dimorphism. *Ethology* 115: 617–626.

Palacín, C., Alonso, J. C., Martín, C. A. & Alonso, J. A. (2017) Changes in bird-migration patterns associated with human-induced mortality. *Conserv. Biol.* 31: 106–115.

Patil, P., Chindarkar, P. & More, S. (2011) Collisions with power lines: a threat to Great Indian Bustard in Bustard Sanctuary, Maharashtra. *Mistnet* 12(4): 7–8.

Pinto, M., Rocha, P. & Moreira, F. (2005) Long-term trends in great bustard (*Otis tarda*) populations in Portugal suggest concentration in a single high quality area. *Biol. Conserv.* 124: 415–423.

Ponomareva, T. S. (1985a) ['Great Bustard.'] In A. M. Borodin, ed. ['*Red Book of the USSR, Part II: birds*.'], Ed. 2. Moscow: Forestry Production. (In Russian.)

Ponomareva, T. (1985b) The Houbara Bustard: present status and conservation prospects [in the USSR]. *Bustard Studies* 3: 93–96. (Translated from *Okhota I okhotnich'e khozyaistvo* 11 [1979]: 26–27.)

Popov, V. V. & Medvedev, D. G. (2010) ['Great bustard.'] P.401 in O. Y. Gaikova, ed. ['*Red book of Irkutsk Oblast'*.] Irkutsk: Time of Wandering. (In Russian.)

Potapov, P. L. & Flint, V. Y. (1987) ['*Birds of the USSR: Galliformes, Gruiformes*.'] Leningrad: Science. (In Russian.)

Purevsuren, T., Dashnyam, B., Dorjderem, S., Bataa, D. & Amarsaikhan, S. (2013) ['Rare birds of Oyu Tolgoi Project area.'] *Ornis Mongolica* 2: 47–55. (In Mongolian.)

Raab, R., Schütz, C., Spakovszky, P., Julius, E. & Schulze, C. H. (2012) Underground cabling and marking of power lines: conservation measures rapidly reduced mortality of West-Pannonian Great Bustards *Otis tarda*. *Bird Conserv. Internatn.* 22: 299–306.

Raab, R., Schütz, C., Spakovszky, P., Julius, E. & Schulze, C. H. (2015) Optimising the attractiveness of winter oilseed rape fields as foraging habitat for the West Pannonian Great Bustard *Otis tarda* population during winter. *Bird Conserv. Internatn.* 25: 366–376.

Rabiee, K. & Moghaddas, D. (2008) A report of Great Bustard *Otis tarda* from northern Iran. *Podoces* 3: 112–113.

Rahmani, A. R. (1989) The Great Indian Bustard: final report on project entitled 'Study of ecology of certain endangered species of wildlife and their habitats'. Mumbai: Bombay Natural History Society.

Rahmani, A. R. (2001) *Status of the Bengal Florican* Houbaropsis bengalensis *in Uttar Pradesh, India*. Mumbai: Bombay Natural History Society.

Rahmani, A. R. (2012) *Threatened birds of India: their conservation requirements*. Mumbai: Oxford University Press (for the Indian Bird Conservation Network).

Rahmani, A. R. (2016) D'Ering Memorial Wildlife Sanctuary: report of summer surveys in 2016. Mumbai: Bombay Natural History Society.

Rahmani, A. R. & Soni, R. G. (1997) Avifaunal changes in the Indian Thar Desert. *J. Arid Env.* 36: 687–703.

Rahmani, A. R., Khongsai, N., Rahman, A., Imran, M., Sangwan, T. & Ojah, S. (2016) Conservation of threatened grassland birds of the Brahmaputra floodplains. Cambridge UK: BirdLife PEP Project; Mumbai: Bombay Natural History Society.

Rahmani, A. R., Jha, R. R. S., Khongsai, N., Shinde, N., Talegaonkar, R. & Kalra, M. (2017) Studying movement pattern and dispersal of the Bengal Florican (*Houbaropsis bengalensis*): a satellite telemetry pilot project 2013–2016, final report. Mumbai: Bombay Natural History Society.

Ramadan-Jaradi, G., Itani, F. & Serhal, A. (2017) Interesting bird records from Lebanon [remaining title omitted]. *Sandgrouse* 39: 187–192.

Rao, K. T. & Javed, S. M. M. (2005) The Great Indian Bustard *Ardeotis nigriceps* Vigors in and around the Rollapadu Wildlife Sanctuary, Andhra Pradesh, India. *Zoos' Print J.* 20: 2053–2058.

Riou, S., Judas, J., Lawrence, M., Pole, S. & Combreau, O. (2011) A 10-year assessment of Asian Houbara Bustard populations: trends in Kazakhstan reveal important regional differences. *Bird Conserv. Internatn.* 21: 134–141.

Riou, S., Combreau, O., Judas, J., Lawrence, M. & Pitra, C. (2012) Genetic differentiation among migrant and resident populations of the threatened Asian houbara bustard. *J. Heredity* 103: 64–70.

Roberts, T. J. (1991) *The birds of Pakistan*, 1. Karachi: Oxford University Press.

Rocha, P. N. A. (2006) Dinâmica populacional e distribuição da Abetarda no Baixo-Alentejo—relação com o uso da terra. PhD thesis, Instituto Superior de Agronomia, Universidade Técnica de Lisboa, Portugal.

Rocha, P., Morales, M. B. & Moreira, F. (2013) Nest site habitat selection and nesting performance of the Great Bustard *Otis tarda* in southern Portugal: implications for conservation. *Bird Conserv. Internatn.* 23: 323–336.

Rokade, S. S., Bali, S. B. & Ingle, P. B. (2017) Depleting grasslands with plant invasion: rising threat for lesser florican. *Internatn. J. Appl. Res.* ISSN Print: 2394-7500, ISSN Online: 2394-5869: 209-210.

Rookmaaker, K., Sharma, A., Bose, J., Thapa, K., Dutta, D., Jeffries, B., Williams, A. C., Ghose, D., Gupta, M. & Tornikoski, S. (2016) *The Greater One-Horned Rhino: past, present and future*. Gland: WWF.

Rustamov, A. K. (1954) ['*Birds of the Kara-Kum desert*.'] Ashgabat: Academy of Sciences of Turkmen SSR. (In Russian.)

Ryabov, V. F. (1982) ['*Avifauna of the northern steppes of Kazakhstan*.'] Moscow: Science. (In Russian.)

Saint Jalme, M. & van Heezik, Y., eds. (1996) *Propagation of the Houbara Bustard*. London: Kegan Paul International; Riyadh: National Commission for Wildlife Conservation and Development.

Sankaran, R. (2000) The status of the Lesser Florican *Sypheotides indica* in 1999. Coimbatore: SACON; Mumbai: Bombay Natural History Society.

Sankaran, R. & Rahmani, A. R. (1990) Recommendations for Lesser Florican conservation. Pp.117–124 in *Status and ecology of the Lesser and Bengal Floricans with reports on Jerdon's Courser and Mountain Quail: final report*. Mumbai: Bombay Natural History Society.

Santana, J., Reino, L., Stoate, C., Borralho, R., Carvalho, C. R., Schindler, S., Moreira, F., Bugalho, M. N., Ribeiro, P. F., Santos, J. L., Vaz, A., Morgado, R., Porto, M. & Beja, P. (2014) Mixed effects of long-term conservation investment in Natura 2000 farmland. *Conserv. Letters* 7: 467–477.

Saparmuradov, D. (2003) ['Population size and status of bustard species in Turkmenistan.'] Pp.83–90 in A. V. Khrustov, ed. ['*Bustards of Russia and adjacent countries*, 2.'] Saratov: Saratov University. (In Russian.)

Saparmuradov, D. (2011) ['Great bustard.'] Pp.276–277 in ['*Red Book of Turkmenistan*.'] Ashgabat: Ylym. (In Turkmen and Russian.)

Sastre, P., Ponce, C., Palacín, C., Martín, C. A. & Alonso, J. C. (2009) Disturbances to great bustards (*Otis tarda*) in central Spain: human activities, bird responses and management implications. *European J. Wildlife Res.* 55: 425–432.

Savchenko, A. P., Baranov, A. A. & Savchenko, I. A. (2012) ['Great Bustard.'] P.93 in A. P. Savchenko, ed. ['*Red Book of Krasnoyarsk Krai*.'] Krasnoyarsk: SFU. (In Russian.)

Schulz, H. (1985) A review of the world status and breeding distribution of the Little Bustard. *Bustard Studies* 2: 131–151.

Seddon, P. J., Saint Jalme, M., van Heezik, Y., Paillat, P., Gaucher, P. & Combreau, O. (1995) Restoration of houbara bustard populations in Saudi Arabia: developments and future directions. *Oryx* 29: 136–142.

Sehhatisabet, M. E., Abdi, F., Ashoori, A., Khaleghizadeh, A., Khani, A., Rabiei, K. & Shakiba, M. (2012) Preliminary assessment of distribution and population size of wintering Little Bustards *Tetrax tetrax* in Iran. *Bird Conserv. Internatn.* 22: 279–287.

Shakula, V. F., Shakula, S. V. & Shakula, G. V. (2017) Little Bustard—natural component of agricultural landscapes of Southern Kazakhstan. Pp.23–25 in A. V. Vinober, U. E. Vashukevich, V. N. Molozhnikov, A. V. Dimitriev, A. N. Yamskov & E. V. Vinober, eds. *Biosphere farming and sustainable development of rural areas*. Irkutsk: Ottisk. (In Russian.)

Shams, K. M. (1985) Occurrence and distribution of bustards in Baluchistan. *Bustard Studies* 3: 51–54.

Shlyakhtin, G. V., Tabachishin, V. G., Khrustov, A. V. & Zav'yalov, E. V. (2004) Ecological segregation of bustards (Otididae) in the north of the lower

Volga region: evolutionary and adaptive aspects. *Russian J. Ecol.* 35: 247–253.

Silva, J. P., Palmeirim, J. M. & Moreira, F. (2010a) Higher breeding densities of the threatened little bustard *Tetrax tetrax* occur in larger grassland fields: implications for conservation. *Biol. Conserv.* 143: 2553–2558.

Silva, J. P., Santos, M., Queirós, L., Leitão, D., Moreira, F., Pinto, M., Leqoc, M. & Cabral, J. A. (2010b) Estimating the influence of overhead transmission power lines and landscape context on the density of little bustard *Tetrax tetrax* breeding populations. *Ecological Modelling* 221: 1954–1963.

Silva, J. P., Estanque, B., Moreira, F. & Palmeirim, J. M. (2014a) Population density and habitat use by female Little Bustards during lek attendance, nesting and brood-rearing. *J. Orn.* 155: 53–63.

Silva, J. P., Palmeirim, J. M., Alcazar, R., Correia, R., Delgado, A. & Moreira, F. (2014b) A spatially explicit approach to assess the collision risk between birds and overhead power lines: a case study with the little bustard. *Biol. Conserv.* 170: 256–263.

Silva, J. P., Catry, I., Palmeirim, J. M. & Moreira, F. (2015) Freezing heat: thermally imposed constraints on the daily activity patterns of a free-ranging grassland bird. *Ecosphere* 6(7): 119.

Silva, J. P., Moreira, F. & Palmeirim, J. M. (2017) Spatial and temporal dynamics of lekking behaviour revealed by high resolution GPS tracking. *Anim. Behav.* 129: 197–204.

Silva, J. P., Correia, R. A., Alonso, H., Martins, R. C., D'Amico, M., Delgado, A., Sampaio, H., Godinho, C. & Moreira, F. (2018) EU protected area network did not prevent a country wide population decline in a threatened grassland bird. *Peer J.* 6: e4284.

Sivakumar, K., Bhardwaj, G. S., Sen, S., Sharma, R. & Dhavale, O. (2014) Status and habitat assessment of Bengal Florican *Houbaropsis bengalensis* in the grasslands of Uttar Pradesh. Dehradun: Wildlife Institute of India.

Sklyarenko, S. L. (2006) ['Overwintering of great bustards in the south and southeast of Kazakhstan.'] Pp.213–220 in S. L. Sklyarenko, ed. ['*Studies of key ornithological territories of Kazakhstan and Central Asia*.'] Almaty: Association for Conservation of Biodiversity in Kazakhstan. (In Russian.)

State Forestry Administration of China (1988) ['*National list of protected wild animals of China*.'] Accessed at http://www.forestry.gov.cn/main/3954/content-959068.html. (In Chinese.)

Surahio, M. I. (1985) Ecology and distribution of Houbara Bustards in Sind. *Bustard Studies* 2: 55–58.

Tarasov, V. V. (2012) ['Little Bustard.'] P.63 in ['*Red Book of Kurgan Oblast'*]. Second edition. Kurgan: Kurgan University. (In Russian.)

Tarasov, V. V. & Primak, I. V. (2013) ['On the status of unprotected rare species of birds in Tyumensk Oblast'.] Pp.125–144 in S. N. Gashev, ed. [*Materials for the second edition of the Red Book of Tyumensk Oblast.*'] Tyumen': TyumenNIIgiprogaz [*sic*]. (In Russian.)

Tarjuelo, R., Delgado, M. P., Bota, G., Morales, M. B., Traba, J., Ponjoan, A., Hervás, I. & Mañosa, S. (2013) Not only habitat but also sex: factors affecting spatial distribution of Little Bustard *Tetrax tetrax* families. *Acta Orn.* 48: 119–128.

Tarjuelo, R., Morales, M. B., Traba, J. & Delgado, M. P. (2014) Are species coexistence areas a good option for conservation management? Applications from fine scale modelling in two steppe birds. *PLoS ONE* 9(1): e87847.

Tarjuelo, R., Barja, I., Morales, M. B., Traba, J., Benítez-López, A., Casas, F., Arroyo, B., Delgado, P. & Mougeot, F. (2015) Effects of human activity on physiological and behavioral responses of an endangered steppe bird. *Behav. Ecol.* 26: 828–838.

Tarjuelo, R., Morales, M., Arroyo, B., Mañosa, S., Bota, G., Casas, F. & Traba, J. (2017) Intraspecific and interspecific competition induces density-dependent habitat niche shifts in an endangered steppe bird. *Ecol. & Evol.* 7: 9720-9730.

Tian X. H., Wang J. J., Xu M. R., Zhang X. R., Wei S. Q. & Huang S. (2001) The first breeding success of captive Great Bustards in Harbin Zoo. *Chinese J. Wildlife* 22(6): 5–7. (In Chinese.)

Totton, S. C., Wandeler, A. I., Zinsstag, J., Bauch, C. T., Ribble, C. S., Rosatte, R. C. & McEwen, S. A. (2010) Stray dog population demographics in Jodhpur, India, following a population control/rabies vaccination program. *Prev. Vet. Med.* 97: 51–57.

Tourenq, C., Combreau, O., Lawrence, M. & Launay, F. (2004a) Migration patterns of four Asian Houbara *Chlamydotis macqueenii* wintering in the Cholistan Desert, Punjab, Pakistan. *Bird Conserv. Internatn.* 14: 1–10.

Tourenq, C., Combreau, O., Pole, S. B., Lawrence, M., Ageyev, V. S., Karpov, A. A. & Launay, F. (2004b) Monitoring of Asian houbara bustard *Chlamydotis macqueenii* populations in Kazakhstan reveals dramatic decline. *Oryx* 38: 62–67.

Tourenq, C., Combreau, O., Lawrence, M., Pole, S. B., Spalton, A., Gao X. J., Al Baidani, M. & Launay, F. (2005) Alarming houbara bustard population trends in Asia. *Biol. Conserv.* 121: 1–8.

Tseveenmyadag, N. (2001) ['Great Bustard in Mongolia.'] *Scientific Work. Inst. Biol. Mongol.* 23: 143–158. (In Mongolian.)

Tseveenmyadag, N. (2003) Great Bustard in Mongolia and future collaboration between Mongolian and Korean researchers. Pp.50–60 in Seoul National University, Ecotech Institute, eds. *Symposium on cooperation between Korea and Mongolia for wildlife conservation*. Seoul, South Korea.

Tseveenmyadag, N. & Bold, A. (2005) ['Birds of Ogii lake and surrounding areas.'] *Birds, Amphib. Reptil. Mong.* 2: 33–40. (In Mongolian.)

UNEP/CMS (2005) Draft action plan for the conservation of the Asian Houbara Bustard. http://www.cms.int/sites/default/files/document/Houbara_Bustard_draft_AP_e_0.pdf.

Vilkov, V. S. (2003) Records of Little Bustard in North Kazakhstan province. *Kazakhstan Orn. Bull.* 2003: 151. (In Russian.)

Villanúa, D., Casas, F., Viñuela, J., Gortázar, C., García de la Morena, E. L. & Morales, M. B. (2006) First occurrence of *Eucoleus contortus* in a Little Bustard *Tetrax tetrax*: negative effect of Red-legged Partridge *Alectoris rufa* releases on steppe bird conservation? *Ibis* 149: 405–406.

Villers, A., Millon, A., Jiguet, F., Lett, J. M., Attié, C., Morales, M. B. & Bretagnolle, V. (2010) Tracking of wild and captive-bred Little Bustards *Tetrax tetrax* from western France, and implications for reinforcement programmes. *Ibis* 152: 254–261.

Vincent, J. (1966–1971) *Red Data Book, 2: Aves.* Morges: International Union for Conservation of Nature and Natural Resources.

Voronova, V. V., Pulikova, G. I., Kim, K. K., Andreeva, E. V., Bekker, V. R. & Aitbaev, T. (2012) The impact of power lines on bird mortality in central Kazakhstan. *Raptors Conservation* 24: 52–60. (In Russian.)

Wang L. (2012) ['Changes in wintering populations and threats to Great Bustards in Yellow River Delta.'] *Shandong For. Sci. Technol.* 2: 71–74. (In Chinese.)

Wang M. Y., González, M. A., Yang W. K., Neuhaus, P., Blanco-Fontao, B. & Ruckstuhl, K. E. (2018) Probable decline of the Great Bustard *Otis tarda tarda* population in NW China. *Ardeola* 65: 291–297.

Wolff, A., Paul, J.-P., Martin, J.-L. & Bretagnolle, V. (2001) The benefits of extensive agriculture to birds: the case of the little bustard. *J. Appl. Ecol.* 38: 963–975.

Wright, H. L., Lake, I. R. & Dolman, P. M. (2012) Agriculture—a key element for conservation in the developing world. *Conserv. Lett.* 5: 11–19.

Wu M. L., Hou J. H., Gao L. J. & Wang X. H. (2011) [The geographical distribution and conservation of Great Bustard in Hebei province, China.] *Sichuan J. Zool.* 30(5): 814–815. (In Chinese.)

Wu Y. Q., Shen J., Liu J., Liu F. Q., Wang S. & Xu X. (2013) ['Analysis of the threatening factors on wintering *Otis tarda* in the Yellow River wetland of Shaanxi Province.'] *Forest Resour. Manag.* 10: 20. (In Chinese.)

Yang W.-K., Qiao J.-F., Combreau, O., Gao X.-Y. & Zhang W.-Q. (2003) Breeding habitat selection by the Houbara Bustard *Chlamydotis* [*undulata*] *macqueenii* in Mori, Xinjiang, China. *Zool. Stud.* 42: 470–475.

Yanushevich, A. I. & Tyurin, P. S. (1959) ['*Birds of Kyrgyzia*.'] Frunze: Academy of Sciences of the Kyrgyz SSR. (In Russian.)

Yao J., Mu D., Liu C., Lu X. & Yao Q. (2011) Captive breeding of Great Bustard *Otis tarda*. *Chinese J. Wildlife* 32: 329–331. (In Chinese with English summary.)

Young, J. K., Olson, K. A., Reading, R. P., Amgalanbaatar, S. & Berger, J. (2010) Is wildlife going to the dogs? Impacts of feral and free-roaming dogs on wildlife populations. *BioScience* 61: 125–132.

Yousefi, M., Kafash, A., Malakoutikhah, S., Ashoori, A., Khani, A., Mehdizade, Y., Ataei, F., Ilanloo, S. S., Rezaie, H. R. & Silva, J. P. (2017) Distance to international border shapes the distribution pattern of the growing Little Bustard *Tetrax tetrax* winter population in northern Iran. *Bird Conserv. Internatn.* doi:10.1017/S0959270917000181.

Zakharov, V. D. & Ryabitsev, V. K. (2008) [*'Red book of Chelyabinsk Oblast.'*] Accessed at http://igz.ilmeny.ac.ru. (In Russian.)

Zarudnyi, N. A. (1903) [*'Birds of eastern Persia.'*] St Petersburg: Imperial Academy of Science. (In Russian.)

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