

# Unconventional habitat choices by some Great Bustard *Otis tarda tarda* populations in Turkey

İBRAHİM KAAAN ÖZGENCİL, MELİSA SOYLUER, MEHMET MAHİR KARATAŞ & FERDİ AKARSU

**Summary:** Great Bustard *Otis tarda tarda* is a globally threatened bird inhabiting the steppe regions of the Palearctic. Although its populations are shrinking fast, Turkey still holds regionally important numbers of the species. However, these remaining populations face a wide array of threats, and understanding their habitat use can help with their conservation. Here, we highlight the marginal and unusual habitat choices that some Great Bustard populations in Turkey are apparently forced to make due to human pressure. Records from islands on a hypersaline lake, an island on a river, a semi-desert plain, and a pine forest are described. We also present more expected findings from some previous work to contribute to the literature on habitat selection by Great Bustards in Turkey. Further studies are required to understand the extent and fitness costs of the use of unconventional habitats by Great Bustards.

## INTRODUCTION

Great Bustard *Otis tarda tarda* is one of the 26 internationally red-listed bird species found in Turkey (IUCN 2020). The species is a natural steppe and grassland bird which, with the coming of agriculture, has partially adapted to living in anthropogenic habitat mosaics (Nagy 2018, Collar & García 2020). Steppes are one of the most degraded and disturbed habitats in Turkey and indeed the world, mainly owing to their ease of conversion (mostly to agricultural fields and settlements) and to their relatively lower attractiveness (Laiolo & Tella 2006, Smelansky & Tishkov 2012, Ambarlı *et al* 2016). This has had detrimental consequences for specialised grassland birds (Suárez-Seoane *et al* 2002, Brennan 2005, Donald *et al* 2006). Currently, although they are protected by law throughout their range, Great Bustards are still very widely hunted (Kessler & Smith 2014, Nagy 2018). Disturbance by agricultural work and other human activities also poses a threat to Great Bustards, by increasing their energy expenditure, collision risk with human-made structures, and reproductive failure rates (Sastre *et al* 2009, Rocha *et al* 2013, Ponce *et al* 2018). Moreover, both hunting pressure and disturbance can also force bird populations to live in suboptimal habitat conditions, which may come with a fitness cost (Thiollay & Probst 1999).

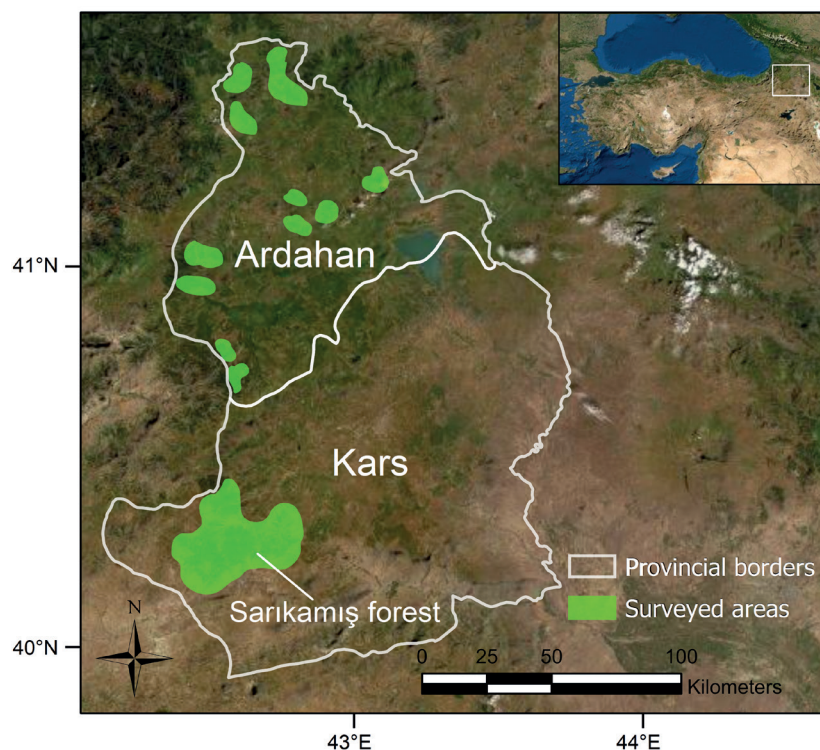
In Turkey, hunting remains the most serious and widespread threat to Great Bustards, and disturbance is among the most widespread of other threats to the species (Özgencil *et al* 2021). The sighting of a female Great Bustard with three chicks at the edge of the Scots Pine *Pinus sylvestris* forest in Sarıkamış, Kars, in the summer of 2011 (Per *et al* 2012) was an extremely intriguing record. Eight years later, video footage of a Great Bustard flying within Sarıkamış forest in September 2019 suggested that the situation needed investigation. In this review, we assemble examples of unusual and marginal habitat choices that some Great Bustard populations in Turkey are possibly being forced to make in response to hunting pressure and disturbance. We also present a short review of other records from Turkey, reporting more usual habitat preferences as a contribution to the literature.

## METHODS

Driven by the intriguing sightings mentioned and documented in Per *et al* (2012) and Özgencil *et al* (2021), in June 2021 one of the authors (FA) surveyed the Scots Pine forests and the openings in these forests in Ardahan and Kars provinces in eastern Turkey (Figure 1). He surveyed the forests and forest edges using walked and driven line transects (Bibby *et al* 2000,



**Figure 1.** Turkey and its provincial borders (grey lines). Provinces where we conducted our fieldwork are labelled. Base map sources: ESRI, GEBCO, DeLorme, NaturalVue.



**Figure 2.** Map showing the surveyed Scots Pine forests in Ardahan and Kars provinces in June 2021. Base map source: ESRI, Earthstar Geographics.

Sutherland *et al* 2004), which can be a useful method for detecting Great Bustards, at least in their usual open-field habitats (Alonso & Alonso 1996). The transects were positioned 900–1,000 m apart, leaving 450–500 m detection range on both sides, which is substantially below the 700–800 m

**Table 1.** Summary of records of unconventional habitat choices by Great Bustards in Turkey. IBA = Important Bird Area.

| Source                     | Location  | Date           | Use                    | Details   |
|----------------------------|---|----------------|------------------------|---|
| Kasperek (1989)            | Çamlıyayla, Mersin, in the Tauruses, southern Turkey            | February 1876  | Migration?             | Exact location not known. 1000-1500 m elevation. Highly mountainous area.   |
|                            | Pozantı, Adana, in the Tauruses, southern Turkey                | March 1876     | Migration?             | Exact location not known. 1000-1500 m elevation. Highly mountainous area.   |
| Dicle Tuba Kılıç pers comm | Islands on Murat river in Upper Murat River IBA, eastern Turkey | Early 2000s    | Lek site               | Exact location not known. Alluvial islands in the river.  |
| Per <i>et al</i> (2012)    | Sarıkamış forest in Kars, eastern Turkey                        | July 2011      | Nesting site           | Scots Pine forest edge. More in Per <i>et al</i> (2012)   |
| DKMP in Kars pers comm     | Sarıkamış forest in Kars, eastern Turkey                        | September 2019 | Not known              | Within Scots Pine forest. Landcover: 80% forest, 20% forest openings  |
| Özgencil & Özcan (2018)    | North and north-west of Aksaray, central Turkey                 | April 2018     | Lek site, resting site | Small islands in a hypersaline lake. Island landcover: 60% halophilic, short-growing herbs, 40% barren salty soil |
|                            |   | April 2018     | Lek site               | Dry and flat semi-desert steppe area. Landcover: 100% salty steppes / semi-desert steppes                         |
|                            |   | May 2018       | Nesting site           | Reedbeds growing around freshwater springs. Landcover: 100% brackish & freshwater marshes                         |

distance given in Alonso & Alonso (1996), to account for the limited visibility in the forest. To our knowledge, nobody has ever surveyed Great Bustards in forests and forest openings in Turkey (although they have been found and surveyed in some woodland areas in other countries: see Discussion). We expected to find the species in the forest openings and margins, so more effort was allocated to these habitats by making sure that these areas were covered by transects in our systematic transect replacement. The surveyed areas are shown in Figure 2. We also used the results of the monitoring surveys conducted by teams from the General Directorate of Nature Conservation and National Parks (DKMP) in Kars and Ardahan provinces. We contacted DKMP in Kars to obtain the footage of Great Bustards they recorded within Sarıkamış forest.

We reviewed the literature from Turkey to collate all records of breeding and wintering Great Bustards in less conventional habitat as gauged from the existing literature, *eg* Cramp & Simmons (1980), Kasperek (1989), Kollar (1996), Kirwan *et al* (2008), Rocha *et al* (2013), and Collar & García (2020). We also collated the unpublished findings of some of our fieldwork in Eskişehir, Ankara, Konya, Aksaray and Denizli provinces in Inner Turkey (Figure 1) to contribute to the literature about the species’ breeding habitat choice (both nesting and lek sites: Morales *et al* 2001) in Turkey.



**Plate 1.** Still from a video of a Great Bustard flying in a Scots Pine forest in Kars in September 2019.  
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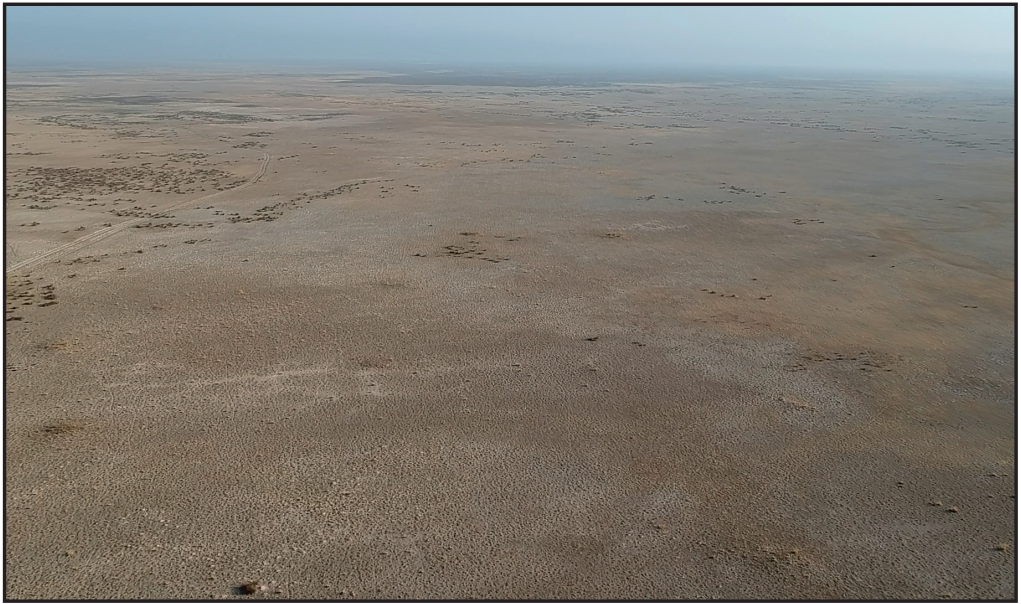
**Plate 2.** Aerial photograph of islands in the hypersaline Tuz lake in Konya and Aksaray provinces, Turkey.  
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## RESULTS

We found several historical records involving cases of unconventional habitat choice by Great Bustards in Turkey (Table 1). An expedition encountered flocks of the species in Mersin, Çamlıyayla, in the Taurus range in February 1876 and near Adana, Pozantı, in March 1876 (Danford 1877, Kasperek 1989). These records are from highly mountainous areas, which Great Bustards do not usually inhabit. In the early 2000s, a group of Great Bustards used to display on an alluvial island in the river in the Upper Murat Valley Important Bird Area in eastern Turkey (D Kılıç pers comm), which, to the best of our knowledge, is the only record of the species using a river island as a lek site. Per *et al* (2012) reported and photographed a female Great Bustard with three chicks at the edge of a Scots Pine forest in Sarıkamış, Kars, in July 2011. In September 2019, DKMP rangers filmed a Great Bustard flying through the same forest (80% Scots Pine, 20% openings) in Sarıkamış (Plate 1).

In an expedition around Tuz lake in the spring and summer of 2018, İKÖ and FA obtained a few records of unconventional habitat choices by Great Bustards. The birds in this region use islands in the hypersaline Tuz lake as lek sites during the day and roosting sites during the night (Özgencil & Özcan 2018). These islands are mostly inaccessible to humans and have sparse beds of a few short-stature, salt-tolerant herbaceous plants such as *Salicornia* (Plate 2).





**Plate 3.** Aerial photograph of the semi-desert Great Bustard lek site north-west of Aksaray, Aksaray province, Turkey. © Umut Tank

Another extraordinary lek site was discovered by İKÖ and FA on an apparently semi-desert salty steppe area north-west of Aksaray, close to Tuz lake, in April 2018 (Plate 3). There was a tiny (c1 m in diameter) freshwater spring within a few hundred metres of the area where several Great Bustards were spotted.

The following month (May 2018), a shepherd told İKÖ and FA that Great Bustards occasionally make their nests in the reedbeds of *Phragmites australis* growing around the freshwater springs north-west of Aksaray, and that he had himself found such a nest with two eggs in early May, when the reeds would have been around 1 m tall. When İKÖ visited the area in June, he found two Great Bustard feathers within these reeds, which were by then 1.5–2 m tall. Given this circumstantial evidence and the fact that the shepherd knows the species very well, we fully trust his story.

FA found no Great Bustards during his surveys in and around the Scots Pine forests in Ardahan and Kars. However, local people confirmed that the species is seen around the edges of the forests and that an injured chick was found by a farmer in a cereal field in Ardahan province in June 2021 and sent to DKMP in Kars for treatment. This is the first record of the species breeding in Ardahan.

Over the last several years, we have also recorded Great Bustards in habitat that was more in line with the species' ordinary preferences. In 2016, FA found a lek site north of Tuz lake in an agricultural mosaic of dry farming (mostly wheat) and ploughed fields. The same site was surveyed by FA and İKÖ in 2018 again, and its land cover, quantified from aerial photographs, involved 75–80% cultivated fields (wheat and barley), 10% ploughed fields, 5–10% semi-natural steppe and 1–5% dirt roads. All four nests found by our crew and local farmers were located in wheat or barley fields. In 2020 MMK surveyed a few lek sites in Eskişehir and Denizli provinces. All were in agricultural mosaics made up of cultivated fields, stubbles, ploughed fields and fallows. One of the three nests found

by MMK was in a wheat field, one in a barley field, and one in a semi-natural steppe dominated by Wild Arugula *Eruca vesicaria* and Tumbleweed *Gundelia tournefortii*.

## DISCUSSION

According to the latest estimates, with 559–780 breeding and 593–775 wintering Great Bustards, Turkey still holds regionally important numbers of the species (Özgencil *et al* 2021). However, Turkish populations have been declining very fast, and they face a wide range of threats (Kirwan *et al* 2008, Karakaş & Akarsu 2009, Özgencil *et al* 2021). From the evidence we have gathered here, we suggest that, in addition to their more direct impacts, widespread hunting pressure and disturbance may be responsible for forcing some of these remaining populations to live under suboptimal conditions.

Normally, Great Bustards avoid both mountainous and wooded areas (Cramp & Simmons 1980, Alonso *et al* 2004, Kirwan *et al* 2008). The winter/early spring records from the Taurus mountains probably referred to migrants, as mentioned in Özgencil *et al* (2021), but given that the species used to breed in areas up to 2500 m in Kyrgyzstan (Yanushevich & Tyurin 1959), the remote possibility remains that a high-elevation breeding population once inhabited the Tauruses. The species' use of wooded areas is, however, better documented. Some Great Bustard populations in Iberia may occupy open-canopied oak *Quercus* spp stands and Olive *Olea europaea* orchards in the breeding season (Cramp & Simmons 1980, Alonso *et al* 2004, Moreira *et al* 2004, Delibes *et al* 2012, Martín *et al* 2012, NJ Collar in litt). Moreover, the eastern subspecies *O. t. dybowskii* is known to utilise openings and edges in the forest-steppe zone in Siberia and northern Mongolia (Mel'nikov & Popov 2000, Goroshko 2002, 2008, Kessler 2015). Birds from some of these populations have been found to regularly lek and nest inside forest openings, and at forest edge (Ponomareva 1986, Goroshko 2002, 2008, Kessler 2015).

Whether these unusual choices of habitat are driven by natural or anthropogenic factors is unclear. There are documented cases of other typically grassland species taking refuge in forest to avoid human pressure, one being the European Bison *Bison bonasus* (Kerley *et al* 2012) and another involving various carnivores in the Sarıkamış forest in Turkey (Chynweth *et al* 2016) where the record of the female Great Bustard was the first of its kind in the country. Our own surveys in Scots Pine forests in Ardahan and Kars failed to locate any Great Bustards, but a more intensive and better-timed survey (in April and May) might prove more productive. The plains surrounding these forests should also be properly surveyed because the whereabouts of the Kars population's lek site(s) are currently unknown, while the injured chick found in Ardahan also points to a local breeding population waiting to be discovered. Certainly, it appears that the Great Bustards in this region must occasionally be utilising the forest habitat, and any conservation management plan should not discount these records.

Reports of Great Bustards breeding on islands on a river in eastern Turkey and a hypersaline lake in central Turkey are further examples of unusual habitat choice by the species in Turkey. Although the island on the Murat river no longer exists (it was lost after dam construction upstream), the islands in the hypersaline lake in central Turkey still seem to support a breeding population. These islands are particularly hard to reach and have never been completely surveyed; the use of drones, which have proved to be important tools in ecology (Schiffman 2014, Chabot & Bird 2015, Blight *et al* 2019), might help in this regard. Great Bustards are largely birds of dry but temperate grasslands and quasi-grasslands, not desert and semi-desert (Cramp & Simmons 1980, Alonso *et al* 2004, Moreira *et al* 2004), so the use of a desert area as a lek site by Great Bustards in Kazakhstan between 2009 and 2011 (Gubin 2015) may represent the impact of human pressure. Consequently, the semi-desert lek site north-west of Aksaray merits study to evaluate the

possible anthropogenic factors that might have led to its use. It should, however, be noted that the unusual habitat choices mentioned in this paper might occur due to a combination of anthropogenic factors and natural predation pressure, rather than the former alone, because these habitats, especially the islands, may offer better protection from natural predators. The fitness costs and benefits to the birds of these choices are also worthy of investigation.

The discovery of a nest within reedbeds near a freshwater spring north-west of Aksaray suggests that overgrazing might be causing additional hardship for the Great Bustards in the region. Overgrazing is quite widespread in the steppes of central Turkey (Ambarlı *et al* 2016, Özgencil *et al* 2021). We saw during our previous surveys in this area that overgrazing leaves no vegetation in which females can nest other than sparse and highly spinose plants (too little cover against predators), reedbeds (risk of flooding) and crops (risk from harvest; Kılıç & Karakaş 2005, Nagy 2018). The biggest lek discovered in this region in 2000 was found in a small plot fenced off against grazing (Heunks *et al* 2001), suggesting that Great Bustards may prefer ungrazed and disturbance-free areas with an abundant herbaceous plant layer.

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- İbrahim Kaan Özgencil, Middle East Technical University, Department of Biological Sciences, Faculty of Arts and Science, Ankara, Turkey; Doğa Derneği (BirdLife Turkey), İzmir, Turkey; Simurg Kuş Yuvası Derneği (Simurg Bird Sanctuary), Ankara, Turkey. kaanozgencil@gmail.com
- Melisa Soyluer, Middle East Technical University, Department of Biological Sciences, Faculty of Arts and Science, Ankara, Turkey.
- Mehmet Mahir Karataş, Department of Biology, Faculty of Arts and Science, Eskişehir Osmangazi University, Eskişehir, Turkey.
- Ferdi Akarsu, Doğa Derneği (BirdLife Turkey), İzmir, Turkey; International Crane Foundation, Baraboo, Wisconsin, USA.