ISSN 1062-3590, Biology Bulletin, 2014, Vol. 41, No. 10, pp. 856–861. © Pleiades Publishing, Inc., 2014.
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Restoration of the Little Bustard Population in the Northern Steppe Trans-Urals

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Received March 29, 2011

Abstract—The dynamics of a population of little bustards in the northern steppe Trans-Urals is considered. After a period of almost complete absence in the 1970s and 1980s, since the early 1990s, temporarily vacant parts of the range have been inhabited again and an increase in the population has been observed. By the beginning of the 21st century, the little bustard had almost regained its former habitat in the region. By the end of the 1990s, the average population density in the agricultural landscape reached 1 ind./km^2. By the end of the first decade of the 2000s, it exceeded 2 ind./km^2. In recent years, the little bustard has rarely been observed in steppe pastures but is found more frequently on perennial grass crops and harvested grain fields, while the bulk of its population (up to 70–80% of all couples) inhabits fallow lands, the appearance and preservation of which is associated with the steady reduction in agricultural production in the last two decades.

Keywords: *Tetrax tetrax*, number, population density, biotopic distribution, steppe Trans-Urals
DOI: 10.1134/S1062359014100057

INTRODUCTION

The little bustard (*Tetrax tetrax* Linnaeus, 1758) is an indigenous inhabitant of steppe landscapes. Manifesting conservatism in the selection of nesting ranges, this species has avoided tilled farmlands for a long time. As a result of the total agricultural development of the steppe zone, by the middle of the 20th century, the majority of its populations had undergone degradation: a significant reduction in numbers, retreat to the south of the northern border of the range, and fragmentation into separate isolated areas (Isakov, 1982; Isakov and Flint, 1987; Belik, 2001).

The main reason for these negative processes was the destruction of the original habitat—plowing of virgin and fallow lands and a significant increase in grazing pressure on the remaining steppe areas, which resulted in intensified processes of digression of steppe vegetation and desertification. The negative consequences for the species could have also been brought about by the broad application of highly toxic preparations intended to combat rodents, in particular, zinc phosphide (Belik, 1997, 1998); several harsh winters also caused mass deaths of birds wintering on the Caspian (Gavrin, 1962; Belik, 2001; and others).

Against the background of a deep depression of populations, the tendency to colonize agricultural fields, especially perennial grasses, increased. Recent decades have seen a gradual restoration in the populations of the little bustard. This process was traced in the north of the steppe Trans-Urals as well. In this paper, we consider the little bustard population dynamics in the region. The stages of recovery of the former range are shown, as well as the changes in the abundance and biotopic distribution of the species associated with it, against the background of changing environmental conditions in the steppe agricultural landscape caused by a significant reduction in agricultural production over the past two decades.

MATERIALS AND METHODS

These studies were performed in 1988–2008 on a key long-term plot in the northern steppe Trans-Urals in the Bredinskii district of Chelyabinsk oblast (52°12′ N, 60°21′ E). This territory is a typical steppe agricultural landscape, comprising cropland and, in areas that are not suitable for agriculture, virgin steppe pastures, which constitute about 30% of the total agricultural land.

Data on the number and biotopic distribution of the little bustard were obtained in the course of route accounting, which covered all major habitat types of birds that occupy steppe agrolandscapes. The main method of data collection was made without limiting the belt of detection of birds with subsequent calculation of the indices of abundance for middle harmonic detection distances (Chelintsev, 1985; Ravkin and Chelintsev, 1990). During the reproductive period, the little bustard population is characterized by the results of surveys in May. On the basis of data on the population density in certain biotopes and the area occupied by them, the weighted average values were calculated for the agro-landscape of the key area as a whole. The

total length of the routes in May was 1255 km. Additional information is provided on the little bustard population dynamics obtained in May 1993 and 1996 at the territory of the Arkhaim museum and nature reserve, which is located 80 km northwest of the key area.

RESULTS AND DISCUSSION

Distribution of species in the region. In the first half of the 20th century, the habitat of the little bustard encompassed the steppe Trans-Urals region, in some places including the forest–steppe—slightly north of the 54th latitude (Ol'shvang, 1938, Shvarts et al., 1951; Zalesskii, I.M. and Zalesskii, P.M., 1931). In the middle of this century, the number of Eastern European populations significantly decreased, and the northern boundary of the range retreated to the south (Belik, 2001). The same fate befell the little bustard population in the steppes of the Trans-Urals and Western Siberia. By the end of the 1970s, the species was hardly ever found in Bashkortostan, Chelyabinsk, Tyumen', Kurgan, Omsk, and Novosibirsk oblasts (Kandaurov, 1986). A similar situation was observed during this period in the neighboring territories of Northern Kazakhstan (Bragin, 1991, 1999). All enumerated regions are on the northern periphery of the species range, where the depression of the population was, evidently, the most profound, often leading to complete disappearance of the birds. In the central regions of this range, against the background of a severe depression of little bustard populations in the middle of the 20th century, some of its colonies were still preserved (Isakov, 1982; L'vov, 1983; Belik, 1986, 2001; Moseikin, 1986, etc.). A similar pattern was observed in the Southern Urals, where in the 1970s, one of the largest populations of the little bustard in the former Soviet Union was preserved (Isakov and Flint, 1987), demonstrating not only stabilization, but even growth of the population in some areas (Chibilev, 1995a, 1995b). Apparently, it is from these centers that the little bustard spread during the period of restoration of its population in the last decades of the 20th century. This process was observed in the steppe Trans-Urals as well—at the southern tip of Chelyabinsk oblast. In the 1970–1980s, the little bustard was virtually absent, only a single finding of it was reliably registered in 1986 (Zakharov, 1989). On the long-term key area in Bredinskii district of Chelyabinsk oblast, during surveys throughout the snowless period in 1988–1990 the little bustard was not detected. It first appeared here in 1991 (Korovin, 1995a, 1997), after which it was registered annually. In the late 1990s–early 2000s, the little bustard was noted to the north: in the Kartalinskii, Varnenskii, and Uiskii districts of Chelyabinsk oblast (Morozov, 1999; Gordienko, 2002; Brusyanin et al., 2010), as well as in the Bashkir Trans-Urals (Valuev et al., 2006). Thus, by the beginning of the 21st century, in the steppe Trans-Urals, the little bustard again settled north of the 54th latitude, which corresponds to the position of the northern boundary of its range in the middle of the 20th century. In Northern Kazakhstan, gradual recovery in the little bustard population after a deep depression began in the mid-1980s (Bragin, 1991, 1999) and 1990s (Berezovikov and Kovalenko, 2001; Erokhov and Berezovikov, 2001, Tarasov and Davydov, 2008). By the end of the century, the species advanced to the northern border of the Kostanai oblast. From the late 1990s to the early 2000s, its nests were registered again in the southern parts of the Kurgan (Naumov, 2001; Ryabitsev et al., 2002; Tarasov, 2002) and Omsk (Yakimenko, 2003) oblasts. These data allow us to state that by the beginning of the 21st century, the little bustard had almost regained its former range in the Trans-Urals.

Population dynamics of the little bustard in the northern steppe Trans-Urals. Detailed representation of the results of this process is given by stationary observations in the most southern district of Chelyabinsk oblast (Bredinskii). The little bustard was not detected on the long-term key plot in 1988–1990 (table). It was first registered here in 1991, when several individuals were observed on a virgin pasture. On May 29, a nest was found in a fescue and feather grass steppe with a predominance of *Stipa lessingiana* (Korovin, 1997, 2004). All findings were restricted to an area of about 5 km^2; on other tracts of virgin pastures with similar conditions, the little bustard was not registered. Little bustards settled on the same plot of virgin land the following year as well; moreover, they were found on the adjacent field of perennial grasses: Hungarian brome *Bromopsis inermis* (Leys) Holub. In the next subsequent seasons, no surveys were carried out in the key area, but little bustards were regularly registered in the same habitats: on virgin steppe pastures and crops of perennial grasses. Thus, in the early 1990s, the little bustard re-entered the permanent ornitocomplex of the key area.

By the end of the 1990s, the abundance of the little bustard amounted to 1.1 ind./km^2, on average, over the agricultural landscape (from 0.4 to 1.6 in some habitats, table), which corresponds to the abundance of this species in the Kustanai steppes surrounding the Trans-Urals region on the eve of their large-scale colonization. Thus, at the end of the 1930s, in the preferred biotopes of the Naurzum Reserve, it ranged from 0.5 to 1.4 ind./km^2 (Ryabov, 1949). By the end of the first decade of the 2000s, a further marked increase in the population density of the little bustard was recorded: compared with the year 2000, on average, it has doubled in the agricultural landscapes of the key area (table).

Evidently, the process of recovery of the little bustard population was not narrowly local, but covered large areas of the steppe Trans-Urals simultaneously. In the same period—the first half of the 1990s—its initial stages were traced in the Arkhaim Museum and Nature Reserve located in the northwestern part of the

Population density of the little bustard at a key site in the steppe Trans-Urals (May), ind./km^2

Year	Virgin pastures	Fallow lands	Perennial grass crops	Stubble fields	Plowed fields	On the whole in the agricultural landscape
1988–1990	0	–	0	0	0	0
1991	0.2	–	0	0	0	0.06
1992	0.2	–	0.2	0	0	0.08
2000	1.3	1.2	1.6	0.4	0	1.1
2001	1.3	1.6	1.5	0	0	1.1
2003	1.2	3.3	1.0	0.6	0	1.2
2004	0	3.3	2.9	1.5	0	1.4
2005	0	2.4	1.3	2.0	3.5*	1.3
2006	0.6	4.5	2.9	3.2	0	2.6
2007	0	6.1	1.4	1.9	0	2.6
2008	0.3	4.8	0.3	2.9	0	2.1

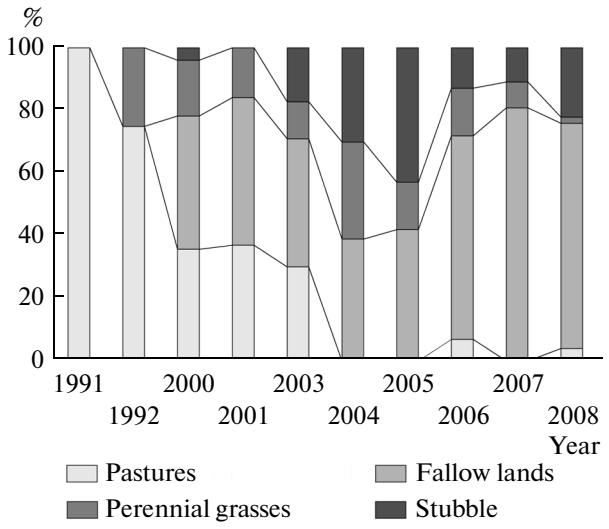
* Stubble field plowed in spring (route length 3 km); the dash signifies the absence of the biotope.

Bredinskii district, 80 km from the key area. An intensive examination of this site in May 1993 yielded only one encounter of the little bustard: in the steppe along the crest of a farmland ridge (Korovin, 1995b). Single findings of it during this period were reported by the staff of the reserve as well. However, three years later, the little bustard was found to be quite common in the reserve (Korovin, 2004). The greatest number of birds was observed in the crops of perennial grasses Hungarian brome and alfalfa *Medicago sativa* L., where by the mapping of stationary males, around a dozen couples were counted (5 ind./km^2). In places, they formed compact group colonies: in an area of about 50 ha sown with Hungarian brome, five males were observed at a distance of 150–200 m from each other. Slightly less frequently, the little bustard was found in virgin steppe (3 ind./km^2). A similar level of abundance was registered in the reserve area in the following years as well (Gashek, 1998, 2006).

Biotopic distribution. Compared with the bustard, the little bustard had long remained a more conservative inhabitant of the virgin steppe, which avoided farmlands (Kirikov, 1966; Golovanova, 1985; Isakov and Flint, 1987; Lindeman and Lopushkov, 2004; Shlyakhtin et al., 2004, etc.). It appears that strict adherence to the original steppe landscapes was one of the main causes of the major depression of little bustard populations following the large-scale agricultural assimilation of the steppe zone. Early in the second half of the 20th century, the plowing of steppes reached a maximum. On the remaining virgin lands, as a result of widespread overgrazing, the processes of digression of vegetation and desertification intensified. With the sharp reduction in the area of steppe habitats suitable for nesting, the tendency toward colonization of tilled lands—primarily perennial grasses—by the little bustard became more pronounced (L'vov, 1983; Belik, 1986, 2001; Moseikin, 1986; Chernobai, 2003 and others). The assimilation of this new niche apparently played a key role in the restoration of the size of its populations (Belik, 2001).

Appearing in the north of the steppe Trans-Urals after a long period of absence, the little bustard began to colonize both fescue and feather grass steppes on virgin pastures and perennial grasses since the first years. Colonization may have occurred mainly by birds that had already mastered this nesting niche. In the subsequent period, restoration of the little bustard population occurred against the background of the deepening economic crisis and decline of agriculture. By the end of the 1990s, significant changes in the ecological appearance of the steppe agricultural landscape had occurred. Reduction in the area of cultivated land led to the appearance of fallow lands, which, on the key plot, constituted by the end of the decade 38% of the total arable land. Simultaneously, the numbers of livestock decreased. By the early 2000s, relative to the level of the late 1980s, the number of cattle declined by half, that of sheep decreased four times, and that of horses, almost ten times (Korovin, 2004). Reduced grazing pressure stimulated the development of demutation steppe vegetation succession, a consequence of which was a significant increase in the height and canopy of virgin pasture grasses, especially noticeable in humid years. Complete cessation of irrigation in this period led to the degradation of alfalfa and Hungarian brome crops, which were replaced by a more drought-resistant crop: wheatgrass *Agropyron* sp.

Against the background of the characterized dynamics of the environmental situation, notable changes occurred in the distribution of the little bustard over the breeding grounds. By the end of the 1990s, their significant diversification was observed: along with virgin pastures and perennial grasses, they



Dynamics of biotopic association of the little bustard (% of the total population of the key area).

included fallow lands and harvested grain fields (figure). The subsequent dynamics of the biotopic distribution reflects the direction and magnitude of changes in the environmental conditions in separate habitats. By the end of the first decade of the 2000s, the little bustard had practically ceased settling on the land masses of virgin steppes. The main cause for avoiding this biotope was, apparently, the change in the vegetation cover in the course of continuing demutational succession. Spring burns held annually on most virgin pastures to burn the accumulated plant waste could also have had a strong negative impact. On the exploited pastures, the high level of disturbance could also have played a role. It should be emphasized that, due to the natural patchiness of conditions, steppe areas with low herbage that are suitable for little bustard populations persist to this day in the form of inclusions and spots of varying size. However, it seems that when choosing habitats, birds react to average, generalized landscape characteristics and do not try to stay on the islands of still remaining suitable habitats.

On perennial grasses, the little bustard population density is experiencing noticeable changes depending on the prevailing conditions. Typically, little bustards settle on the crops mowed in the previous year, on which the herbage does not exceed 15–20 cm in the spring. However, in recent years, haying has been carried out selectively, only in areas with a relatively high stock of phytomass, while degraded old crops often remain wholly unmowed. In the subsequent spring, the dry herbage of such sites is reminiscent of the grass steppes, reaching a height of 30–40 cm. Little bustards tend to avoid such sites.

Fallow lands have been colonized by little bustards almost since their appearance. On fallow lands overgrown with wild grasses, they choose sites with the scarcest and lowest vegetation. Against the background of powerful tall herbage prevailing at this stage of succession, such sites occur as edaphically determined modifications of vegetation. With the development of restorative succession, during which a reduction in the average height and canopy of the vegetative cover occurs, as well as a significant increase in its spatial heterogeneity, the attractiveness of fallow lands for the little bustard increases. The average population density of the species in successive series from young (2–3 years) to middle-aged (4–7 years) and long-term fallow lands (8–10 years and older) changed respectively from 1.7 to 3.2 and 4–5 ind./km^2. At some sites of old fallow lands, the local abundance of the little bustard reached maximum values: 20–30 ind./km^2. In recent years, the main part of the nesting population of little bustards in the studied area—up to 70–80%—concentrated on fallow lands (figure). It should be noted that the fallow lands, especially long-term ones, served as one of the main breeding ground for the little bustard in the past (Ryabov, 1949; Kirikov, 1966; Kostin, 1978, etc.).

In the last decade, the little bustard has been assimilating harvested crop fields, represented in spring by the stubble of cultivated cereals. In recent years, it has settled on such fields regularly and the population density has reached here 2–3 ind./km^2, second only to that of fallow lands (table). Fall plowing of winter tillage is currently held on a limited scale, and plowed fields appear mostly in the period of presowing treatment. It is interesting in this connection to mention the fact of registration of displaying little bustard males on fresh large-lump plowed fields (table). Evidently, the birds had settled among the high wheat stubble and did not leave the field after deep plowing of it with a turn plow, after which its surface was covered with large lumps and ridges of soil with tufts of stubble and green shoots sticking out. This example indicates the formation of sufficiently strong ecological links with field agrocenoses in little bustards.

The birds that settle on harvested fields often fall into an "ecological trap," when in the process of presowing treatment of the soil all nests die. Favorable nesting conditions can emerge only in the fields left fallow.

CONCLUSIONS

In the northern steppe Trans-Urals, after years of deep depression in the second half of the 20th century, when the little bustard was practically absent for 2–3 decades, from the beginning of the 1990s, the restoration of its population in the region began. In the early stages, this process is likely to have occurred owing to settling to the north and northeast of the central districts of the birds' habitat, in particular the Southern Urals. An important prerequisite for restoring populations was the realization of the potential ecological plasticity of the species: change to nesting in agrocenoses, primarily on perennial grasses and fallow lands. Enduring an unfavorable situation in most parts of the steppe landscapes original for the species (limited area, overgrazing and associated vegetation

digression, and in the period of sharp reduction in the grazing pressure: development of the productive tall grass phytocenoses) and expanding the range of nesting habitats due to agricultural fields could be crucial. The colonization of birds that have already assimilated this new nesting niche can provide a quick, abrupt increase in the number of species in the temporarily vacant sections of the area. The bulk of couples often settle immediately on the fields of perennial grasses. Change in the environmental conditions in the steppe agrolandscape against the background of the significant decline in agricultural production in the 1990s–early 2000s stimulated deepening processes of adaptation of the little bustard to the conditions of agrocenoses. In the key area in the steppe Trans-Urals, within a relatively short period of several years, a shift in a significant part of birds to nesting on fallow lands and harvested fields of grain occurred. The observed changes are obviously of adaptive nature as after the deterioration in the conditions in the initial and previously cultivated habitats (virgin steppe and perennial grasses), they provided not only the preservation, but also a conspicuous further population growth.

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Translated by N. Smolina