Breeding Conditions for Birds in the Nowaday Farmlands of European Russia: The Impact of Agriculture Intensification and Polarization, Part I: Habitats

T. V. Sviridova*, L. V. Malovichko, G. V. Grishanov, and P. D. Vengerov

*A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, 119071 Russia
*bRussian State Agrarian University—Moscow Timiryazev Agricultural Academy, Moscow, 127434 Russia
*cInstitute of Living Systems, Immanuel Kant Baltic Federal University, Kaliningrad, 236040 Russia
*dPeskov Voronezh State Nature Biosphere Reserve, Centralnaya usadba, Goszapovednik, Voronezh, 394080 Russia

Received April 18, 2018; revised October 27, 2018; accepted October 29, 2018

Abstract—The recession of agriculture in Russia from approximately the mid-2000s changed to an increase, which was accompanied by a reversion to intensive technologies; market transition to cultivation of quick payback crops (potatoes, rapeseed, sunflower) and raising pigs and poultry instead of cattle and the transition from grazing of cattle to an indoor keeping system. The rates of this increase are not equal in different economic sectors and regions of European Russia. It is more pronounced in the Black Soil zone and in the southern part of European Russia, as well as in some of regions in the southern Non-Black Soil zone. These changes have been particularly evident during the past decade and entail changes in the crop structure and development of new areas of agriculture in some regions and are determined both by socio-economic factors and current climate changes. In general, the present-day trend in the development of agriculture is that pastures and most hayfields are becoming unnecessary, whereas the demand for arable fields is increasing. Modern agriculture intensification is different from the intensification of the mid-20th century, since it takes place under conditions when large areas are still abandoned and therefore becoming more overgrown. As a result a considerable polarization of bird habitats has formed in European Russia with vast perennial abandoned lands that are already unsuitable for breeding of typical grassland species alternating with increasingly intensively cultivated fields.

Keywords: birds, agriculture, arable fields, abandoned lands, intensification, habitat polarization

DOI: 10.1134/S1062359020100234

Agricultural lands belong to the most widespread habitats in Europe, the physiognomy and environment of which for birds depend on socio-economic conditions along with natural and climatic conditions (Lyuri, 2010, Nefedova, 2013; Stoate et al., 2009; Newton, 2017). The intensification of agriculture in the 1950s—1980s had negative consequences for the numbers of most meadow and steppe birds (Golovanova, 1975; Pain and Pienkowski, 1997; Tucker and Evans, 1997). The wide-scale recession of agriculture that occurred across vast areas of Northern Eurasia in the 1990s had ambivalent consequences for birds. The abundance and species diversity of birds increased in many areas after the decrease in the agricultural pressure, but then the numbers of most typical farmland birds started to decrease and some species stopped breeding in the areas where abandoned fields and grasslands had transformed into forested lands or wetlands (Korovin, 2004; Vengerov, 2005; Melnikov and Khrulyova, 2011; Amosov and Asoskova, 2016; Grishanov, 2007, 2016; Sviridova et al., 2016; Verhulst et al., 2004; Dylgerova et al., 2015). These processes have been taking place simultaneously with a steady decrease in the numbers of farmland birds in Europe since the 1970s, and this decrease significantly correlates with the indices that reflect the intensification of agriculture (Donald et al., 2006).

The recession of agricultural production in Russia has started to change to an increase since the middle of the 2000s (Nefedova, 2013, 2017), which entails new qualitative and quantitative changes of bird habitats (Vengerov, 2010; Malovichko and Blokhin, 2016; Sviridova et al., 2016). The goal of our review is to assess the current state of the habitats of typical farmland birds on cultivated fields of European Russia. This review focuses on changes in the cultivation structure and technologies in four model regions located in different natural and economic regions and the birds that breed on various crop fields. The current polarization...
of bird habitats in agro-landscapes of European Russia is described in the first part of this paper.

MATERIALS AND METHODS

The assessment of the current state of bird habitats in European Russia was conducted in four model regions: Kaliningrad, Moscow, and Voronezh Regions and Stavropol Territory. The assessment is based on our personal field observations and analysis of published sources and official statistics. The latter are predominantly represented in the databases of the Russian Federal State Statistics Service (Rosstat; http://www.gks.ru) and the Federal Service for State Registration, Cadastre, and Cartography (Rosreestr; https://rosreestr.ru), as well as in reports of the Ministry of Agriculture of the Russian Federation (http://mcx.ru/).

The territory of Kaliningrad Region belongs to the subzone of mixed coniferous-broad-leaved forests. Moscow Region is almost completely located in the forest zone, and only the southernmost part of it is situated in the forest steppe zone. The forest steppe zone prevails in the greater part of Voronezh Region and nearly 1/7 of the southern part of the region belongs to the steppe zone. Stavropol Territory is almost entirely dominated by the steppe zone; its northeastern and eastern parts are occupied by semi-desert landscapes, and the forest steppe landscape is common for the southern part of the Stavropol Upland. According to the natural and agricultural zoning, Kaliningrad Region and Moscow Region belong to the Baltic and Central Russian provinces of the southern taiga forest zone, respectively. Voronezh Region belongs to the Central Russian province of the forest steppe zone in the north and to the South Russian province of the forest steppe in the south. Stavropol Territory is located mainly within the Ciscaucasian provinces of the steppe and forest steppe zones (Prirodno-sel'skohoziaistvennoe rayonirovanie ..., 1983). All model regions are well developed agriculturally. At the beginning of 2017, agricultural lands covered 37.5% of Moscow Region, 53.5% of Kaliningrad Region, 78% of Voronezh Region, and 87.5% of Stavropol Territory (Otzyvnoye dannye ..., 2017).

RESULTS AND DISCUSSION

Changes in Habitats and Living Conditions of Birds in Agricultural Lands of European Russia

As elsewhere in the country, the extensive agriculture in model regions, which was aimed at greater production by constantly expanding farmlands, has gradually changed to a much more intensive agriculture by increasing the technological load on already vast by that time reclaimed land (Lyuri et al., 2010; Vinogradova, 2017). In the twentieth century, ploughing of meadows and steppes, intensive grazing and mowing, and considerable significant chemicalization of agriculture had a significant negative impact on the numbers of meadow and steppe birds (Golovanova, 1975; Ryabov et al., 1984; Belik, 2000; Grishanov, 2016). One of the few benefits for this group of birds was extended land irrigation in a number of southern regions, for example in Stavropol Territory (Blokhin and Blokhina, 2001), as well as draining of marshy seaside meadows in Kaliningrad Region, which was carried out as early as the second half 19th century and the first half of the 20th century (Grishanov, 2016). At the same time or somewhat earlier, a number of species, such as some waders, Common Quail, Grey Partridge, and Montagu’s Harrier, extended their habitats to the north through newly developed agricultural lands and some species, such as the Eurasian Skylark, Calandra Lark, Northern Lapwing, Common Quail, and Western Yellow Wagtail, successfully adapted to breeding on cultivated fields (Golovanova, 1975; Butiev and Ezhova, 1988; Belik, 2000; Shitikov, 2000).

The changes in bird habitats during the agriculture crisis which began in Russia in the 1990s were no less enormous (Galushin et al., 2001). The species composition and abundance of most birds breeding on agricultural lands of the model regions increased in the first years after reduction of the agricultural pressure (Vengerov, 2005; Svirdova et al., 2006; Grishanov, 2016). However, the long-term abandonment of fields and meadows led to their transformation to scrublands or reed thickets, forests, and wetlands. As a result most typical farmland birds suffered a population decline and were replaced by forest, shrub and waterbird species, which is more pronounced in the forest and forest steppe zones (Vengerov, 2010; Grishanov, 2016; Svirdova et al., 2016). This process continues today, especially in the northern regions of European Russia (Mischenko et al., 2018).

However, in this review we want to draw attention to the gradual growth of agriculture, which started in European Russia in the second half of the 2000s (Nefedova, 2013), and the present-day changes in bird habitats associated with it. The rates of this growth are not equal in both different economic sectors and different regions. It is geographically more pronounced in the Black Soils zone and in the southern part of European Russia as well as in a number of regions in the southern part of the Non-Black Soil zone, but not in the Non-Black Soil zone in general (Nefedova, 2017). Economic growth is more evident in crop production, pig-breeding, and poultry farming, but there is still a negative development trend in cattle farming in many regions, even in comparison with the level seen five years ago (Nefedova, 2017; Table 1).

Stavropol Territory and Voronezh Region are characterized by an earlier growth of agriculture due to the development of crop production (Ioffe et al., 2014), while an increase in agricultural production in Kaliningrad and Moscow Regions has mainly been observed during the last 5–8 years (Vinogradova, 2017).
2017; data of the Federal State Statistics Service). With a still slow rate of production growth, the overall course for intensification has been widely applied in the direct (economic) sense of this term, i.e., getting more profit from smaller areas of farmland within a shorter time.

As for animal husbandry, preference is given to pig and poultry breeding instead of cattle breeding, owing to their quick payback (Nefedova, 2013). Dairy cattle breeding has massively switched to the indoor keeping system; as a result pastures have disappeared as a class of habitats in many regions (Sviridova et al., 2016). Beef cattle is kept in intensively used pens or on almost year-round exploited pastures (Rol' kulturnykh pastbishch ..., 2010), which are unsuitable for successful breeding of birds (Sviridova, 2008). Crop production has shifted towards the cultivation of quick payback crops: potatoes (Solanum tuberosum L., 1753), rapeseed (Brassica napus L., 1753), flax (Linum sp. L., 1753), sunflower (Helianthus sp. L., 1753), maize (Zea mays L., 1753), and fodder grain. Grain and maize are increasingly used for fattening cattle and poultry instead of hay, which was used before the crisis (Rol' kulturnykh pastbishch ..., 2010). On the remaining hayfields, multiple grass cuttings for haylage, silage, and green fodder are practiced, which are accompanied with an early start of haying.

In a number of regions, new sectors of agriculture that were not typical prior to the crisis period are developing. Thus, in Kaliningrad Region the number of sheep doubled by 2015 compared to the “pre-crisis” data in 1990, which is determined by social reasons, such as the influx of migrants from the former southern republics of the Soviet Union, where sheep breeding used to be a traditional industry (Tselevaya programma ..., 2013). In Stavropol Territory, where distant-grazing cattle breeding was highly developed until the 1990s, pastures are being ploughed now for cereal crops. In this case, the agriculture trends are influenced by climatic and economic factors: the current increase in temperature and rainfall allows cultivation of wheat in areas where it was risky before (Antonov, 2009); in addition, grain is a more profitable and reliable product for farmers than cattle breeding products (Nefedova, 2013).

Thus, the current trend of agriculture development is that pastures and most hayfields are becoming unnecessary, whereas the demand for arable fields is increasing. Such a turn of events is extremely unfavorable for birds of meadow and steppe complexes, which had been adapting to extensive agriculture conditions for millennia, and even after the change of this situation in the 20th century because of technological progress, the majority of species primarily inhabited pastures and hayfields rather than cultivated fields (Golovanova, 1975; Lebedeva and Butiev, 1995; Tucker and Evans, 1997; etc.).

Until the 1990s the area of arable lands in Russia was 133–134 mln ha, approximately 92% of which were sown, leaving from 7 to 14.5 mln ha as bare fallows in different years (Agroekologicheskie sostoyanie ..., 2008). The progressive reduction in sown fields during the economic crisis reached the minimum area in Russia in 2007 (approximately 75 mln ha); then it began to increase, but not as quickly as it had previously dropped, amounting to approximately 80.2 mln ha in 2017 (the data of the Federal State Statistics Service). Since 2006 the return of fallows on former arable lands into cultivation has been partially subsidized according to federal and regional programs (Nikiforova, 2016) and is more pronounced in the Central Black Soil zone and in the southern part of European Russia (Nefedova, 2017). In Voronezh Region and Stavropol Territory, almost all formerly abandoned arable lands that were still suitable for crop rotation after many years of abandonment have already become cultivated (Doklad o sostoyanii ..., 2017; Table 2). The difference from the level of 1990 in these regions (Fig. 1a) is determined by the area of significantly forested territories or lands that are unsuitable for cultivation (gullies and ravines), which were ploughed in the soviet years, but now their use is unprofitable.

Over the past decade, the ratio of cultivated crops has significantly changed in many regions of European Russia, including the model regions (Fig. 2). The share of winter cereals has significantly increased everywhere; this is less pronounced only in Moscow Region. In Moscow and Kaliningrad Regions, rapeseed cultivation has become more widespread; moreover, in Kaliningrad Region, the share of this crop had

Table 1. Rates of growth of cattle and pig breeding in the model regions as of 2015 (according to the data of the Federal State Statistics Service)

| Time period       | Cattle breeding | Pig-breeding |
|-------------------|-----------------|--------------|
|                   | KR  | MR  | VR  | ST  | KR  | MR  | VR  | ST  |
| Growth by 1990    | –83 | –80 | –55 | –61 | 9   | –39 | –18 | –52 |
| Growth by 2005    | –45 | –36 | 6   | –26 | 613 | 222 | 194 | 50  |
| Growth by 2010    | –8  | –15 | 19  | –14 | 68  | 22  | 55  | 22  |

* KR, Kaliningrad Region; MR, Moscow Region; VR, Voronezh Region; ST, Stavropol Territory.
increased even before 2006 (Grishanov, 2007) and has remained relatively constant since then. As for the crops grown in forest steppe and steppe regions, the proportion of sunflower is rather substantial there, especially in Voronezh Region. The share of vegetable crops is noticeable everywhere, except for Stavropol Territory. In addition to the sown areas shown in Fig. 2, there is a large proportion of bare fallow in the crop rotation in steppe and forest steppe regions: it was 20% of arable land in Voronezh Region and 23% in Stavropol Territory in 2006, and 14% and 18% in 2016, respectively.

We will emphasize once more that the return of arable lands into agricultural rotation, which is negligible at present within Russia in comparison with the preceding decrease, is accompanied by the increased intensification of their use. Among other things, this is manifested in a steady increase in the use of mineral fertilizers since 2005. Kaliningrad Region has proved to be one of leaders in this area, since input of fertilizers there is much higher than on average in Russia (Fig. 1b). Poisons such as pesticides, herbicides, and fungicides have also started to be used again (Vengerov, 2010; Shevtsov et al., 2012).

Modern agriculture intensification is different from the intensification of the mid-20th century, since it takes place under conditions when large areas are still abandoned and therefore becoming more overgrown. According to the 2014–2015 statistics, 40% of former arable lands in Russia (Doklad o sostoyanii …, 2017) as well as 12% of hayfields in European Russia (Trofimov et al., 2014) are covered by shrubs and forests. Former pastures are also widely subject to afforestation (Rol’ kulturnykh pastbishch …, 2010). In most regions, official statistics greatly underestimate the area of fallow lands. However, both the data of the Ministry of Agriculture of the Russian Federation (Doklad o sostoyanii …, 2017) and the minimum area of real fallows in former arable lands in the model regions that we calculated based on the methods published earlier (Smelyansky, 2012) reflect similar trends (Table 2).

The polarization of modern agriculture that entails changes in the physiognomy of bird habitats was
caused by socio-economic factors and is evident not only on the country scale (Fig. 3), but also on the scale of individual regions. Thus, in the eastern and southern parts of Kaliningrad Region, i.e., in the areas that are less dependent on drainage, crop production is actively developing and areas of intensive pastures are increasing, while most of the areas in the northern and western parts are still not cultivated and are being overgrown by shrubs; as for coastal meadows, they have turned into reedstands or wetlands (Grishanov, 2016).

Initially, polarization of agricultural lands is largely determined by natural and climatic factors (Prirodno-selskokhoziaisstvennoe rayonirovanie ..., 1983). Among them, in addition to the sum of positive annual temperatures, an important role is played by the hypothermic effect, which is an indicator determined by a complex balance of moisture intake and evaporation, both of which are also directly affected by temperature (Antonov, 2009). It is this effect that determines the final wetness conditions on agricultural lands, i.e., bird habitat conditions in the context of our review. This balance is especially important in more southerly regions. Thus, in Stavropol Territory polarization of agriculture conditioned by the moisture gradient was evident both in the years of intensification in the 20th century and in the years of economic recession. Animal husbandry prevailed there in areas with a lack of moisture, i.e., in the northeastern part of the region, whereas crop production was common in the areas with higher precipitation. The border between these sectors coincided with the isoline of the precipitation level of 400 mm (Atlas zemel’ ..., 2000). And the conditions for breeding of farmland and steppe birds were more favorable in the quite arid areas, where animal husbandry was developed, despite the lack of moisture there.

Natural and climatic factors also determine the features of the present-day overgrowing of agricultural lands. Thus, the current physiognomy of bird habitats in the agricultural landscape in the northern and southern parts of Voronezh Region is largely determined by the humidity level. In the northern part of the region, forests and groves of Silver Birch (Betula pendula Roth, 1788) are often formed on wet abandoned lands, while sparse tree and shrub vegetation of Crab Apple (Malus silvestris L., 1768), Common Pear (Pirus communis L., 1753), Siberian Elm (Ulmus pumila L., 1753), Wild Rose (Rosa sp. L., 1753), etc., is more common in the more arid central and southern parts of the region. Besides the amount of precipitation, the higher humidity level in the northern part of the region is also caused by weak surface runoff within the Oka–Don Lowland (Ekologo-geograficheskie raiony ..., 1996).

In recent decades, the average annual temperature has been rising. Winters have become warmer, and the amount of precipitation in the main vegetation period has been increasing. The degree of instability (contrast) of a number of climatic indicators has grown (Antonov, 2009; Volkov et al., 2013). These factors together with long-term land abandonment and deterioration of drainage systems have led to waterlogging of many former arable lands and grasslands (Grishanov, 2016; Sviridova et al., 2016). Reduced grazing and mowing contribute to the development of mesophytic
vegetation in the forest steppe and steppe zones (Vengerov, 2010; Neronov, 2002). In recent years natural steppe and meadow vegetation and winter crops have been vegetating earlier and faster because of climate warming and increased precipitation (Antonov, 2009), and thus they are often too high and unsuitable for some ground nesting bird species. The latter trend is usually aggravated by heavy input of mineral fertilizers on fields (Robinson and Sutherland, 2002). Thus, current climatic changes in Stavropol Territory (Antonov, 2009) have given the opportunity to get a guaranteed payback from grain harvests by applying significant additional doses of fertilizers in the areas where only grazing was previously profitable. This has resulted in ploughing of pastures for winter wheat (Triticum sp. L., 1753) in the zone of former domination of animal husbandry.

Thus, changes in the structure of cultivated crops, the current state of abandoned lands, as well as the speed of their afforestation, and, ultimately, polarization of farmland bird habitats are determined by the cumulative impact of socio-economic factors and current climate changes.

CONCLUSIONS

Significant polarization of the agricultural landscape and consequent polarization of habitat conditions for birds breeding there have developed during the past few decades in European Russia. This polarization can be observed both within individual regions and on the pan-European scale, being determined by modern socio-economic and climate changes.

To be continued.

COMPLIANCE WITH ETHICAL STANDARDS

The authors declare that they have no conflict of interest. This article does not contain any studies involving animals or humans performed by any of the authors.

REFERENCES

Agroekologicheskoe sostoyanie i perspektivy ispolzovaniya zemel’ Rossii, vybyvshikh iz aktivnogo selskokhoziaistvennogo oborota (Agroecological Condition and Perspectives of Utilization of Lands of Russia not Involved in Intensive Agricultural Production), Romanenko, G.A., Ed., Moscow: Rosinformagrotekh, 2008.

Amosov, P.N. and Asoskova, N.I., The influence of agriculture on populations of birds in the north of European Russia), in Ptitsy i sel’skoe khozyaistvo: materialy Mezhdunarodnoi ornitologicheskoi konferentsii “Ptitsy i sel’skoe khozyaistvo: sovremennoe sostoianie, problemy i perspektivy izucheniya” (Birds and Agriculture: Proceedings of the Conference “Birds and Agriculture: Up-to-Date State, Problems, and Prospects of Study”), Zheleznova, T.K. and Malovichko, L.V., Eds., Moscow: Znak, 2016, pp. 11–15.

Antonov, S.A., Dynamics of agroclimatic resources in agricultural landscapes of the Stavropol Territory and directions for optimization of agricultural systems, Extended Abstract of Cand. Sci. (Biol.) Dissertation, Moscow, 2009.
Responses to recent social-economic transformations in Galushin, V.M., Belik, V.P., and Zubakin, V.A., Bird reflectivities of the study and conservation, Rostov-on-Don: Rostov. Gos. Pedagog. Univ., 2000. Blokhin, N.F. and Blokhina, T.I., Vodnye resursy Stavropol’ya (Water Resources of the Stavropol Territory), Stavropol: Stavropol Kraivodzhh, 2001. Butiev, V.T. and Ezhova, S.A., Structure of bird populations at agricultural lands in the taiga region of the European part of the USSR, in Morphology, Systematics and Ekology zhitvornikh (Morphology, Systematics, and Ecology of Animals), Alekseev, V.N., Ed., Moscow, 1988, pp. 28–38. Doklad o sostoyanii izpolzovaniya zemel’ sel’skokhozaystvennogo naznacheniya Rossiiskoi Federatsii v 2015 g. (A Report on the State of Exploitation of Agricultural Lands in the Russian Federation in 2015), Moscow: Rosinformagrotekh, 2017. Donald, P.F., Sanderson, F.J., Burfield, I.J., and Van Bommel, F.P.J., Further evidence of continent-wide impacts of agricultural intensification of European farmland birds, 1990–2000, Agricult., Ecosyst., Environ., 2006, vol. 116, pp. 189–196. Dyulgerova, S., Gramatikov, M., Pedashenko, H., Vassilev, K., Kati, V., and Nikolov, S.C., Farmland birds: a preliminary assessment of principal impacts of agricultural intensification of European farmland birds, 1990–2000, Agricult., Ecosyst., Environ., 2006, vol. 116, pp. 189–196. Galushin, V.M., Belik, V.P., and Zubakin, V.A., Bird responses to recent social-economic transformations in northern Eurasia, in Dostizheniya i problemy ornitologii Severoi Evrazii na rubezhe vekov: trudy mezhdunar. konf. “Aktual’nye problemy izucheniya i okhrany ptits Vostochnoi Evropy i Severnoi Azii” (Achievements and Problems of Ornithology of Northern Eurasia at the Turn of Centuries: Proceedings of the International Conference “Urgent Problems of Bird’s Study and Protection in Eastern Europe and Northern Asia,” Republic of Tatarstan, January 29–February 3, 2001), Kurochkin, E.N. and Rakhimov, I.I., Eds., Kazan: Magarif, 2001, pp. 429–440. Grishanov, G.V., Birds of the agricultural lands of the Kaliningrad Region: a preliminary assessment of principal changes, in Programma “Monitoring luga—polevykh ptits”: predvaritel’nye itogi i perspektivy (The Program “Monitoring of Common Farmland Birds: Preliminary Results and Prospect”), Mischenko, A.L., Ed., Moscow: OOO Tsfirovichok, 2007, pp. 18–22. Grishanov, G.V., Evolution of agricultural landscapes as a driver of biological diversity of birds in the south-east of the Baltic region, in Pitsy i sel’skoe khozaystvo: materialy I mezhdunarodnoi ornitologicheskoi konferentsii “Pitsy i sel’skoe khozaystvo: sovremennoe sostoyanie, problemy i perspektivy izucheniya” (Birds and Agriculture: Proceedings of I International Ornithological Conference “Birds and Agriculture: Up-to-Date State, Problems, and Prospects of Study”), Zheleznova, T.K. and Malovichko, L.V., Eds., Moscow: Znak, 2016, pp. 66–72. Golovanova, E.N., Pitsy i sel’skoe khozaystvo (Birds and Agriculture), Leningrad: Leningrad, 1975. Ekologo-geograficheskie raiony Voronezhskoi oblasti (Eco-geographic Areas of the Voronezh Oblast), Milkov, F.N., Ed., Voronezh: Voronezh. Univ., 1996. Ioffe, G., Nefedova, T., and de Beurs, K., Agrarian transformation in the Russian breadbasket: contemporary trends as manifest in Stavropol, Post-Soviet Affairs, 2014, vol. 30, no 6, pp. 441–463. Korovin, V.A., Pitsy v agrolithozaftakh Urala (Birds in Agricultural Landscapes of the Urais), Yekaterinburg: Ural. Gos. Univ., 2004. Lebedeva, E.A. and Butiev, V.T., Wildlife conservation value of traditional Russian farmland, in Farming on the Edge the Nature of Traditional Farmland in Europe, Peterborough: JNCC, 1995, pp. 82–89. Lyuri, D.I., Goryachkin, S.V., Karavaeva, N.A., Denisenko, E.A., and Nefedova, T.G., Dinamika sel’skokhozaystvennykh zemel’ Rossi v XX veke i postagrogennoe vosstanovlenie rastitel’nosti i pochv (Dynamics of Agricultural Lands in Russia in 20th Century and Postagrogenic Restoration of Vegetation and Soils), Moscow: GEOS, 2010. Malovichko, L.V. and Blokhin, G.I., Influence of agriculture on the living conditions of birds in the south of Russia, in Pitsy i sel’skoe khozaystvo: materialy I mezhdunarodnoi ornitologicheskoi konferentsii “Pitsy i sel’skoe khozaystvo: sovremennoe sostoyanie, problemy i perspektivy izucheniya” (Birds and Agriculture: Proceedings of I International Ornithological Conference “Birds and Agriculture: Up-to-Date State, Problems, and Prospects of Study”), Zheleznova, T.K. and Malovichko, L.V., Eds., Moscow: Znak, 2016, pp. 202–209. Melnikov, V.N., and Krhulyova, O.B., Post-technogenic successions of the ornithocomplexes of the Eastern UpperVolga region. Part II. Bird population dynamics in the course of overgrowing of neglected arable lands, Povolzh. Ekol. Zh., 2011, no 4, pp. 532–536. Mischenko, A.L., Sukhanova, O.V., Amosov, P.N., and Melnikov, V.N., Meadow birds at the waning traditional pasture animal husbandry, in Pervyi Vserossiiskii Ornitol. Kongress, Tezisy dokladov (First All-Russian Ornithological Congress, Abstracts of Papers), Popovkina, A.B. and Kharitonov, S.P., Eds., Tver, 2018, pp. 227–228. Nefedova, T.G., Desyat’ aktuel’nykh voprosov o sel’skoi Rossii: otvety geografa (Ten Topic Issues about Rural Russia: Answers of a Geographer), Moscow: Lenand, 2013. Nefedova, T.G., Twenty-five years of Post-Soviet Russian agriculture: geographic trends and contradictions, Izv. Ross. Akad. Nauk, Ser. Geogr., 2017, no 5, pp. 7–18. Neronov, V.V., Dynamics of vegetation and rodent populations in southern Kalmykya in changing environment, Extended Abstract of Cand. Sci. ( Biol.) Dissertation, Moscow, 2002. Newton, I., Farming and birds, New Nat. Ser., 2017, vol. 135. Nikiforova, E.O., Measures to involve unused agricultural lands in economic turnover, Ross. Elektron. Nauchn. Zh., 2016, no 2, pp. 32–42. Otkrytie dannye Rosreestra (Open data of Rosreestr), Moscow, 2017. https://rosreestr.ru/wps/portal/cc_ib.opendata. Accessed October 25, 2017. Pain, D.J. and Pienkowski, M.W., Farming and Birds in Europe, London, UK: Academic, 1997.
BREEDING CONDITIONS FOR BIRDS IN THE NOWADAY FARMLANDS

Prirodno-sel'skokhozyaistvennoe raionirovanie i ispol'zovanie zemel'nogo fonda SSSR (Natural and Agricultural Zonation and Exploitation of Lands in the USSR), Moscow, Kolos, 1983.

Robinson, R.A. and Sutherland, W.J., Post War changes in arable farming and biodiversity in Great Britain, J. Appl. Ecol., 2002, vol. 39, pp. 157–176.

Role' kulturnykh pastishch v razvitii mochnogo skotovodstva Nchernozennoi zony Rossii v sovremennyykh usloviakh (Role of Improved Pastures for Development of the Dairy Cattle Breeding in the Non–Black Earth Zone of the Russian Federation in Current Conditions), Laretin, N.A., Kutuzov, A.A., and Kosolapova, V.M., Eds., Moscow: Ugreshskaya Tipografiya, 2010.

Ryabov, L.S., Likhatskyi, Yu.P., and Vorobyov, G.P., The bustard (Otis tarda) and the little bustard (Otis tetrax) in the Voronezh Region, Ornithologia, 1984, no. 19, pp. 164–170.

Shevtsov, A.C., Ilyukh, M.P., and Khokhlov, A.N., Antropogennaya eliminatsiya nazemnykh pozvonochnykh Tsentral'nogo Predkavkaz'ya (Anthropogenic Elimination of Terrestrial Vertebrates in the Central Ciscaucasia), Stavropol: Alfa Print, 2012.

Shitikov, D.A., Spatiotemporal structure of fauna and populations of birds on agricultural lands of the European North of Russia, Cand. Sci. (Biol.) Dissertation, Moscow, 2000.

Smelyansky, I., How widespread are abandoned lands in the steppe region of Russia?, Stepnoi Byull., 2012, no. 36, pp. 4–7.

Stoate, C., Baldi, A., Beja, P., Boatman, N.D., Herzon, I., van Doorn, A., Snoo, G.R., Rakosy, L., and Ramwell, C., Ecological impacts of early 21st century agricultural change in Europe—a review, J. Environ. Manage., 2009, vol. 91, no. 1, pp. 22–46.

Sviridova, T.V., Dynamics of numbers and distribution of waders (Charadrii) in agricultural landscapes of the Moscow Region, Extended Abstract of Cand. Sci. (Biol.) Dissertation, Moscow, 2008.

Sviridova, T.V., Volkov, S.V., Grinchenko, O.S., Zubakin, V.A., Kontorschikov, V.V., Konovalova, T.V., and Koltsov, D.B., Impact of farming intensity on birds of agricultural landscapes in the north of Moscow region, in Razvitie sovremennoi ornitologii v Severnoi Evrazii. Trudy XII mezhdunarodnoi ornitologicheskoi konferentsii (Current Advances in Ornithology in Northern Eurasia, Proceedings of XII International Ornithological Conference), Belik, V.P., Ed., Stavropol: Stavropol. Gos. Univ., 2006, pp. 371–399.

Sviridova, T.V., Volkov, S.V., Grinchenko, O.S., and Koltsov, D.B., Monitoring of birds and their habitats in agricultural landscapes in the north of Moscow Region: results of 20 years of observations, in Ptitsy i sel'skoe khozayastvo: materialy I mezhdunarodnoi ornitologicheskoi konferentsii "Ptitsy i sel'skoe khozayastvo: sovremennoe sostoyanie, problemy i perspektivy izucheniya" (Birds and Agriculture: Proceedings of the Conference “Birds and Agriculture: Up-to-Date State, Problems, and Prospects of Study”), Zheleznova, T.K. and Malovichko, L.V., Eds., Moscow: Znak, 2016, pp. 268–277.

Trofimov, I.A., Kosolapov, V.M., Trofimova, L.S., and Yakovleva, E.P., Agrolandscape—ecological zoning of grazing lands in European part of Russia, Usp. Sovrem. Estestvoznan., 2014, no. 12 (1), pp. 116–119.

Tselevaya programma Kaliningradskoi oblasti “Razvyitie ovtsedovstva i kozovodstva Kaliningradskoi oblasti na 2013–2015 gody”, Prilozh. k postanovleniyu Pravitel'stva Kaliningradskoi oblasti v red. ot 17.09.2013, № 703. (Special-Purpose Program of the Kaliningrad Region “Development of Sheep Breeding and Goat Breeding in the Kaliningrad Region in 2013–2015”. Supplement to Administrative Regulation of the Government of the Kaliningrad Region on September 17, 2013, no. 703), Kaliningrad, 2013. http://base.garant.ru/9876444/5389421bbda7f41eb2d1iec4dd4c33/.

Accessed January 15, 2018.

Tucker, G.M. and Evans, M.I., Habitat for Birds in Europe. A Conservation Strategy for the Wider Environment, BirdLife Conservation Series no 6., Cambridge, UK: BirdLife International, 1997.

Vengerov, P.D., Ptitsy i maloispolzuyemye selskokhozyaistvennye zemli Voronezhskoi oblasti (perspektivy vostanovleniya stepnoi avifauny) (Birds and Set-Aside Agricultural Lands in Voronezh Region: Prospects of Resumption of Steppe Avifauna), Voronezh: Krivichi, 2005.

Vengerov, P.D., Exploitation of agricultural lands and the state of vertebrate fauna in the steppe of the Voronezh region after 1991, Stepnoi Byull., 2010, no 29, pp. 42–48.

Verhulst, J., Baldi, A., and Kleijn, D., Relationship between land-use intensity and species richness and abundance of birds in Hungary, Agricult., Ecosyst., Environ., 2004, vol. 104, pp. 465–473.

Vinogradova, O.L., Evolution of models of agricultural practices in Baltic countries and Kaliningrad Region (from 1890 to 2016), Vestn. Balt. Fed. Univ. im. I. Kanta, Ser. Estestv. Med. Nauki, 2017, no 3, pp. 21–28.

Volkov, S.V., Grinchenko, O.S., and Sviridova, T.V., Changes in climate and weather parameters and their correlation with spring arrival of the Common crane (Grus grus) in northern Moscow region, Zool. Zh., 2013, vol. 92, no 7, pp. 834–840.

Translated by L. Solovyova