

Short Communication

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## Invasion of the Black woodpecker (*Dryocopus martius* L.) (Picidae, Aves) into the Dyakovsky (Saltovsky) forest on the array of sands near the Yeruslan river

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**Abstract.** The paper considers the fact of the black woodpecker (*Dryocopus martius* L.) colonization of the Dyakovsky (Saltovsky) forest area, which occupies more than 18,000 hectares on the Yeruslan sands in the Saratov and Volgograd Trans-Volga regions. This forest area is located 25 km from the semi-desert of the Caspian lowland. According to our data, the black woodpecker appeared in the Dyakovsky forest in the winter of 2011–2012 after an extensive fire in the very hot summer of 2010. The mass of dead trees led to an outbreak of xylophagous development, which most likely led to the emergence of a settled population of the black woodpecker in the Dyakovsky forest. For 10 years, we have been conducting observations of the named population. Using the route method, parameters of its density in the winter period were determined, part of the nesting sites was identified, which confirms the year-round habitation and reproduction of the black woodpecker in the Dyakovsky forest. Our observations of the black woodpecker dispersal in the Trans-Volga region are consistent with the data of those authors who established the appearance of this species on the Lower Volga in the Volga-Akhtuba floodplain. In all likelihood, the black woodpecker dispersal in the Trans-Volga region is associated with both some change in the structure of habitats, with some increase in the abundance of this species in the main part of the habitat, and with other factors cited in this work. According to modern concepts, the location of habitats is determined by the “climatic space”, which is potentially suitable for the settlement of a particular species. Other factors interacting with the climate determine the actual development of the territory of this space by the species. Such facts of changes in the boundaries of the habitats of separate species as a result of climate change and factors interacting therewith are widespread in the world.

**Keywords:** Trans-Volga region, Dyakovsky forest, black woodpecker, invasion, emergence of a stable population

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The Yeruslan sand massif is located in the south of the Saratov Trans-Volga region on the border with the Volgograd region (Atlas of the Saratov region, 1978) in the sub-zone of southern fescue-feather grass steppes (Rodin, 1933; Tarasov, 1968, 1975, 1977) on light chestnut soils (Galkin, 1935; Usov, 1948; Levina, 1959; Boldyrev, 1997). The territory of the massif is 18,642 ha (Orlov, Kaiser, 1933). These sands occupy the second above-floodplain terrace of the Yeruslan, which river is the last left-bank tributary of the Volga river.

V. N. Gorin (1988) identified a number of associations on the territory of the Yeruslan sands associated with various relief elements. Steppe communities are located on the upper slopes of sandy hillocks on tied-sandy primitive soils dominated by Polesian fescue (*Festuca polesica* Zapal.) and wild rye (*Secale silvestre* Hoppe). Forest and shrub cenoses are located in the lower parts of slopes, and cereal oak forests are located on sandy loamy soddy forest soils. The ground cover is dominated by ground reed grass (*Calamagrostis epigeios* L.), spirea crenate (*Spiraea crenata* L.) on light loamy and sandy low-humus soils. The grass stand is dominated by downy brome (*Anisantha testorum* L.) and Austrian sagebrush (*Artemisia austriaca* Jacq.). Meadow communities and aspen forests on flat areas are described. The composition of meadow cenoses is dominated by narrow-leaved bluegrass (*Poa angustifolia* L.), ground reed grass and common meadowsweet (*Filipendula vulgaris* L.). The soils are light loamy meadow calcareous. Aspen forests are confined to sandy loam forest malts. The bedstraw (*Galium physocarpum* Ledeb.) predominates in the ground cover. Birch forests of the downy birch (*Betula pubescens* L.) on loamy forest malts and meadow-bog communities on light loamy meadow-boggy soils are confined to the bottoms of inter-mound depressions. Vesicular sedge (*Carex vesicaria* L.) predominates in the ground cover of birch forests. Meadow-bog associations are formed by sharp sedge (*Carex acuta* L.), single-scaled spike rush (*Eleocharis uniglumis* Shult.), tame bedstraw (*Galium rivale* Griseb.), and cinquefoil goose (*Potentilla anserina* L.).

According to the latest forest inventory carried out in 1993 by the 2<sup>nd</sup> Voronezh expedition of the Voronezhlesproekt enterprise on an area of 18184 ha, the forested area occupies about 40% of the territory. Plantations of natural origin and forest crops occupy 22.3 and 17.7%, respectively. The areas of sands and glades are very large; they occupy 33.9 and 12.0% of the territory, respectively. The fraction of agricultural land – hay-fields, arable land, pastures and orchards, as well as unclosed forest crops and dead plantations is quite large. The list of forest-forming species includes 25 species of tall and low-stemmed trees, as well as shrubs. The main forest-forming species are pussy willow (*Salix acutifolia* Willd.), birch (*Betula pubescens* L. and *B. pendula* L.), small-leaved elm (*Ulmus pumila* L.), and pine (*Pinus silvestris* L.), which occupy 22.1, 20.3, 19.5, and 18.2% of the forested area, respectively. It should be noted that the main area of pine forests (more than 80%) is represented by forest cultures. Quite significant areas are occupied by oak (*Quercus robur* L.), represented mainly by crops (7.4% of the forested area), aspen (*Populus tremula* L.) (3.6%), green ash (*Fraxinus excelsior* L.) (3.6%), and ash-leaved maple (*Acer negundo* L.) (2%). The plantings were no more than 90 years old. Forest stands under 20 years old and aged 21 – 40 years occupied 37 and 39.3% of

the forested area, respectively. Thus, young plantations absolutely prevailed. The share of middle-aged tree stands (41–60 years) is also significant (19.7%). Older plantations occupied a small area (0.4%). On the territory of the forest, tree stands predominated with a density of 0.6–0.7 (54.0% of the area). Low-density forest stands (the density 0.5 and below) amounted to 38.8%, while high-density ones (0.9–1.0) accounted for 0.7% only. The productivity fluctuation range of forest stands is very wide (the bonitet from I to V). Overall, however, productivity is quite low. Tree stands of bonitet IV (35.6% of the forested area) and V (31.3% of the forested area) prevail.

In mid-August 2020, we described the vegetation of several forest groves and an oak grove located on the above-floodplain terrace of the Yeruslan river. The vegetation was described using standard procedures (Ramensky, 1971; Zagreyev et al., 1992; Andreyeva et al., 2002). In our study of forest stands, an eye-measuring method was used. To determine the average height and diameter, several randomly selected trees were measured in each community. The stock of forest stands was evaluated according to standard tables of the sums of the cross-sectional areas and stocks of plantations of the Central Research Institute of Forestry. When describing the living ground cover, the degree of development and the main dominant species were taken into account.

The grove, where the nesting station of the black woodpecker (*Dryocopus martius* L.) was located, was 100×40 m in size and was located on the second above-floodplain terrace the Yeruslan in an inter-mound depression (Fig. 1).

The structure of the grove is complex. It consists of the main part – an old-growth aspen forest, an adjoining middle-aged birch forest and a forest edge, consisting of aspen undergrowth mixed with shrubs.

The main part is a two-tiered tree stand. The first tier is dominated by aspen with a small admixture of birch. The age of the aspen is about 70 years, the average height is 22 m, and the average diameter is 28 cm. The bonitet is II. The aspen condition is strongly weakened. The birch is about 50 years old. The average height is 21 m, and the average diameter is 24 cm. The bonitet is I. The tier density is 0.5. The state of the birch is weakened. The composition of the second tier is mixed. The birch and aspen of 30 years old are represented equally therein. The average height of the birch is 15 m, the average diameter is 16 cm.



**Fig. 1.** General view of the birch-aspen grove with traces of vital activity of the *Dryocopus martius* (Photo by A. Yu. Kudryavtsev, August 15, 2020)

The average height of the aspen is 14 m, the average diameter is 16 cm. The tier density is 0.3. The productivity of the tree stand is  $170+50 = 220 \text{ m}^3/\text{ha}$ . Dead aspen was noted in the amount of about  $30 \text{ m}^3/\text{ha}$ , windbreak amounted to  $10 \text{ m}^3/\text{ha}$ , as well as windfall of aspen ( $20 \text{ m}^3/\text{ha}$ ) and birch ( $10 \text{ m}^3/\text{ha}$ ). The average diameter of dead wood and windfall of aspen is 28 cm, and that of birch is 20 cm. The age of undergrowth consisting of aspen with an admixture of birch is 10 years. Its height is 3 m, and its diameter is 2 cm. The quantity is 4 thousand things /ha. The sparse undergrowth consists of hawthorn (*Crataegus sanguinea* Pall.) about 2.5 m high. The sedge (*Carex pilosa* Scop.) predominates in the ground cover with a small admixture of reed (*Phragmites australis*). The birch forest is about 40 years old. Its average height 18 m, the average diameter is 22 cm. The tier density is 0.7. The bonitet is II. The productivity of the tree stand is  $140 \text{ m}^3/\text{ha}$ . The edge is formed by dense shrub thickets of hawthorn and blackthorn (*Prunus spinosa* L.) about 3 m high with a single admixture of Russian broom (*Chamaecytisus ruthenicus*). Aspen clumps at the age of 10 years in the amount of 4 thousand things/ha were also noted there. Its height is 3 m, the diameter is 2 cm.

The second nesting station of the black woodpecker we examined is the oak grove, located on the first above-floodplain terrace of the Yeruslan. It stretches in a narrow belt (about 100 m wide) along the river's right bank. A border consisting of white poplar (*Populus alba* L.) adjoins immediately to the coast. Along the border with open spaces, there is an edge consisting mainly of thorns (Fig. 2). The tree stand is formed by the pedunculate oak. Its age, evaluated by counting tree rings on the stumps of sawn trees, is approximately 75 years. The average oak height is 26 m, the average diameter is 48 cm. The tier density is 0.6. The bonitet is I. The productivity of the tree stand is  $240 \text{ m}^3/\text{ha}$ . The oak trees are characterized by good growth and healthy condition.

In addition to the oak, isolated specimens of the elm (*Ulmus laevis* Pall) were noted. The undergrowth of medium density consists of the Tatar maple (*Acer tataricum* L.)



**Fig. 2.** View of the oak grove with traces of the vital activity of *Dryocopus martius* from the edge (Photo by A. Yu. Kudryavtsev, August 17, 2020)

with an admixture of bird cherry (*Padus avium* Mill) and rose hips (*Rosa majalis* Herrm). May lily of the valley (*Convallaria majalis* L.) absolutely predominates in the ground cover. Single withered specimens of elm and bird cherry are noted. Some diagnostic signs allow us to classify the examined plantation as a type of forest, namely, maple-lily oak forest (floodplain's).

The bird fauna of the SALTovsky (Dyakovsky) forest on the Yeruslan sands was described by V. V. Gruzdev (1955) and L. G. Dinesman (1960). In their reports,

the black woodpecker was not represented in this forest area. There is information about black woodpecker nesting in the Saratov Trans-Volga region in the works by L. A. Lebedeva (1967, 1968, 1969), who noted the nesting of this species in the floodplain forests of the Bolshoy Irgiz river. According to L. A. Lebedeva and D. P. Mozgovoy (1968), the black woodpecker is common in the floodplain forests of the Volga river valley, from the northern borders of the Saratov Trans-Volga region to the mouths of the Bolshoy and Maly Irgiz, penetrating through the floodplain forests of these rivers into the steppe regions. S. N. Varshavsky et al. (1994) noted this species on the outskirts of the Engels city in the first half of the 1990s. The book by E. V. Zavialov et al. (2007) contains no information about the black woodpecker habitat in the Dyakovsky forest.

We found a black woodpecker in the Dyakovsky (Saltovsky) forest in the winter of 2011–2012. Since that time, we have been observing this species in the forest groves on the Yeruslan sands in all seasons of the year. The appearance of the black woodpecker in the Yeruslan forest on the sands could be associated with the unusually hot summer of 2010, when, due to a natural fire in August as a result of a dry thunderstorm, the fire swept through 2/3 of the forest covering more than 18 thousand ha. During the fire, which lasted more than a week, a significant number of pine plantations and natural birch-aspen groves completely burned out. However, a significant number of non-removed dead pine and deciduous trees remained, and hitherto the trunks of these trees lie throughout the entire forest area, where the fire took place. Naturally, as a result of this, an outbreak of xylophagous numbers occurred, which en masse colonized these dead trees, which is a common phenomenon for such a case (Ilyinsky, 1958; Isaev, Girs, 1975). In all likelihood, this circumstance led to the emergence of a sedentary population of the black woodpecker in the Dyakovsky (Saltovsky) forest.

To estimate the population density of the black woodpecker, we used the transect counting method (counting in a limited strip) (Romanov, Maltsev, 2005). The population density per km<sup>2</sup> is calculated by the formula  $N = X / (L \times h)$ , where  $N$  is the population density, individuals/km<sup>2</sup>;  $X$  the number of recorded individuals;  $h$  the detection band-width, km; and  $L$  the route length, km. The density of the species under consideration in the forest groves on the Yeruslan sands is very low. According to our route counts carried out in the winter periods since 2011–2012 to 2020–2021, the parameters of the dynamic series of the black woodpecker density (ind./100 ha) for 10 years of observations are as follows:  $M = 0.08 \pm 0.005$ ;  $\sigma = 0.014$ ;  $v = 17.5\%$ , where  $v$  is the coefficient of variation, %. The total length of routes in November–



**Fig. 3.** A hollow of *Dryocopus martius* in an aspen tree at a height of 12 m (Photo by O. S. Oparina, March 20, 2020)



**Fig. 4.** Wood chips under an aspen with a hollow of *Dryocopus martius* (Photo by M. L. Oparin, April 28, 2020)

Lower-Volga region, are recorded at the end of the third decade of February. As nesting stations in the considered woodland, the black woodpecker chooses the aspen groves and floodplain oak forests described above (Fig. 3 – 5).

Our survey carried out at the end of March 2017 and at the end of February–March 2020 made it possible to reveal nesting areas of the black woodpecker in the Dyakovsky (Saltovsky) forest (Fig. 6).

The nearest habitats of the black woodpecker in the Saratov Trans-Volga region are 100 and 200 km from the Dyakovsky (Saltovsky) forest (Lebedeva, 1967, 1968, 1969; Lebedeva, Mozgovoy, 1968; Varshavsky et al., 1994). Therefore, the dispersal of the black woodpecker in the Trans-Volga region has led to the emergence of a small in



**Fig. 5.** A hollow of *Dryocopus martius* in a white poplar at a height of 14 m in the floodplain forest of the Yeruslan river in the Polet tract (Photo by A. B. Mamaev, March 2017)

February these years was 9690 km with a fixed width of 0.1 km (0.05 km on each side of the transect); in total, 75 specimens of the black woodpecker were met. Basically, the woodpecker keeps in aspen and birch-aspen groves, in the floodplain oak forests of the Yeruslan river with an admixture of white poplar, bird cherry and other types of trees, but sometimes it can also be found in old plantings of small-leaved elm.

Mating calls of black woodpecker males in the Dyakovsky forest, as in other areas of the

Lower-Volga region, are recorded at the end of the third decade of February. As nesting stations in the considered woodland, the black woodpecker chooses the aspen groves and floodplain oak forests described above (Fig. 3 – 5).  
number (about several tens individuals), but a stable population that has existed for 10 years in a grove forest on the Yeruslan sands. In all likelihood, this is a result of the ongoing expansion of the species in the Lower-Volga region. This phenomenon is also noted by other authors. According to the information published by E. V. Gueva et al. (2015), the black woodpecker has reached the Volga-Akhtuba floodplain during its expansion. According to these authors' assumption, the black woodpecker penetrated into the Akhtuba river floodplain through the Don floodplain forests and the forest



plantations of the Volga-Don Canal; the dispersal of this species from the north along the right bank of the Volga river is difficult due to the absence of old forests there below the village Gorny Balykley.

In all likelihood, the changes in the Dyakovsky (Saltovsky) forest, which occurred in connection with the extensive 2010 fire, caused some transformation of habitats, which led to the introduction of the black woodpecker (MacArthur et al., 1966). In all likelihood, the dispersal of the black woodpecker in the Trans-Volga region is associated with both the change in the structure of habitats (Hanski, 2007), with the increase in the abundance of this species in the main part of its range / habitat, and with other factors given by us in this work. According to modern concepts, the location of habitats is determined by the "climatic space", which is potentially suitable for the dispersal of a particular species; other factors interacting with the climate determine the actual development of this area by this species (Harrison et al., 2001). Such facts of changes in the habitat boundaries of certain species as a result of climate change and factors interacting with it are widespread in the world (Burton, 1995; Parmesan, Yohe, 2003; Root et al., 2003).



**Fig. 6.** Nesting areas of *Dryocopus martius*, revealed by us in the Dyakovsky forest (data of 2017 and 2020): 1 – nesting area, 2 – forest area, 3 – dirt roads

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## INVASION OF THE BLACK WOODPECKER

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## ВСЕЛЕНИЕ ЖЕЛНЫ (*DRYOCOPUS MARTIUS* L.) (PICIDAE, AVES) В ДЯКОВСКИЙ (САЛТОВСКИЙ) ЛЕС НА ПРИЕРУСЛАНСКИХ ПЕСКАХ

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**Аннотация.** Рассматривается факт заселения желной (*Dryocopus martius* L.) Дьяковского (Салтовского) лесного массива, занимающего больше 18000 га на Приерусланских песках в саратовском и волгоградском Заволжье. Этот лесной массив расположен в 25 км от полупустыни Прикаспийской низменности. Желна, по нашим данным, появилась в Дьяковском лесу зимой 2011 – 2012 гг. после обширного пожара, произошедшего очень жарким летом 2010 г. Масса погибших на корню деревьев привела к вспышке развития ксилофагов, что, скорее всего, привело к возникновению оседлой популяции желны в Дьяковском лесу. В течение 10 лет нами проводятся наблюдения за названной популяцией. При помощи маршрутного метода определены параметры ее плотности в зимний период, выявлена часть гнездовых участков, что подтверждает круглогодичное обитание и размножение желны в Дьяковском лесу. Наши наблюдения за расселением желны в Заволжье согласуются с данными авторов, установивших появление этого вида на Нижней Волге в Волго-Ахтубинской пойме. По всей вероятности, расселение желны в Заволжье имеет связь как с изменением структуры местообитаний, с увеличением численности этого вида в основной части ареала, так и с другими факторами, приведенными нами в этой работе. По современным представлениям, расположение ареалов определяется «климатическим пространством», которое потенциально пригодно для расселения конкретного вида. Другие взаимодействующие с климатом факторы определяют фактическое освоение видом территории этого пространства. Подобные факты изменения границ ареалов отдельных видов в результате изменения климата и связанных с ним факторов имеют широкое распространение в мире.

**Ключевые слова:** Заволжье, Дьяковский лес, желна, инвазия, возникновение устойчивой популяции

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