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Article

Expansion of the breeding range of the Oriental Stork *Ciconia boyciana* in the Razdolnaya River basin (south-west of Primorsky Krai) in 2024

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Abstract. The Oriental Stork is one of the specially protected bird species of the Russian Far East, listed in the Red Data Books of various levels. In recent years, an increase in its number has been noted in most of its breeding range. This is facilitated by both abiotic factors and the progressive synanthropization of the Oriental Stork. Since the 1970s, these birds have increasingly begun to nest on power line poles, which allowed storks to settle in places where there were no nesting trees before. Previously, the southern border of nesting in the Primorsky Krai was in the south of the Khanka lowland, and in 2023, its reproduction was first noted in the Razdolnaya River basin, 36 km southwest of the former nesting sites. In 2024, colonization continued here and seven new nests were found. The article describes the characteristics of the nests found, as well as analyzes the causes and prospects for expanding the range of the Oriental Stork in the south-west of Primorye.

Keywords: Ciconiiformes, Russian Far East, synanthropization, range expansion

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Научная статья

Расширение гнездового ареала дальневосточного аиста *Ciconia boyciana* в бассейне реки Раздольной (юго-запад Приморского края) в 2024 году

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Аннотация. Дальневосточный аист – один из особо охраняемых видов птиц российского Дальнего Востока, занесенный в Красные книги различного уровня. В последние годы отмечен рост его численности на большей части гнездового ареала. Этому способствуют как абиотические факторы, так и поступательно идущая синантропизация дальневосточного аиста. С 1970-х гг. эти птицы все чаще стали гнездиться на опорах ЛЭП, что позволило аистам поселиться в тех местах, где до этого не было гнездопригодных деревьев. Ранее южная граница гнездования в Приморском крае проходила по югу Приханкайской низменности, а в 2023 г. было впервые отмечено его размножение в бассейне р. Раздольной, в 36 км к юго-западу от прежних мест гнездования. В 2024 г. расселение здесь продолжилось, и были найдены семь новых гнезд. В статье приводятся характеристики найденных гнезд, а также анализируются причины и перспективы расширения ареала дальневосточного аиста на юго-западе Приморья.

Ключевые слова: Аистообразные, Ciconiiformes, Дальний Восток России, синантропизация, экспансия

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Introduction

The Oriental Stork *Ciconia boyciana* Swinhoe, 1873 is one of the specially protected “flag” bird species of the Far East and Russia as a whole. It is an endemic to East Asia, listed in the Red Data Books of the Russian Federation (category 1 – endangered species, 1st priority of environmental protection measures) and all subjects where it inhabits, as well as in the IUCN Red List (category EN C2a(ii)) (Andronov and Andronova, 2021). In addition to Russia, this species lives in Northeastern China, and restoration of artificial population is underway in Japan and South Korea, from where the species disappeared (Andronov and Andronova, 2021; Dugintsov, 2008; Ha et al., 2024).

The current global population is estimated at 7000–7.500 individuals, of which about 5.000 birds live in Russia (Andronov and Andronova, 2021). According to other sources, the number of Oriental Storks wintering in China in January 2022 exceeded 9,600 individuals (Yang et al., 2023). In our country, the Far Eastern stork lives in the Primorsky Krai and Khabarovsk Krai, the Amur Region, and the Jewish Autonomous Region (Andronov and Andronova, 2021; Dugintsov, 2008). His flights to Sakhalin are known (Kartavykh, 1976; Trukhin, 2016), as well as in Megino-Kangalassky ulus (Central Yakutia), where nesting is suspected but not proven (Krivoshapkin and Sazonova, 2021).

There is rather extensive scientific literature dedicated to the biology and the conservation of the Oriental Stork in Russia (Adnagulov, 2023; Andronova et al., 2022, 2023; Averin, 2020; Dalnevostochnyi aist v Rossii, 2000; Dugintsov, 2008, 2019; Dugintsov and Ivanov, 2022; Glushchenko, 1985; Glushchenko et al., 2016; Kozhevnikov, 2009; Maslova et al., 2016; Mrikot and Mrikot, 2015; Pakusina et al., 2024; Pronkevich et al., 2014, 2021; Sasin, 2013; Sasin and Senchik, 2011; Sasin et al., 2021; Senchik and Sasin, 2008; Sostoyanie dalnevostochnogo aista..., 2011; Surmach et al., 2022, etc.).

For a long time, the world population of the Oriental Stork was in a state of depression, however, since the late 1990s, there has been a slow but steady increase in numbers (Andronov and Andronova, 2021). This trend is noted in all regions of the Russian Federation where this species lives (Andronova et al., 2022; Averin, 2020; Pronkevich et al., 2021; Sasin et al., 2021; Surmach et al., 2022).

In Primorsky Krai, the distribution of the Oriental Stork is almost entirely associated with the Amur basin, where the southern boundary of the known range is located in the south of the Khanka lowland (Volkovskaya-Kurdyukova, 2011). Outside this territory, a single nesting was recorded in the lower reaches of the Avvakumovka River (Olginsky district) on June 20, 1970 (Nazarov and Labzyuk, 1975). The number and distribution of the population of the Oriental Stork in Primorsky Krai are subject to significant long-term dynamics. In particular, in the Khanka lowland (the largest settlement in Primorsky Krai), during almost the entire twentieth century, the number of birds of this species steadily decreased until 1987, when a historical minimum of 5 breeding pairs has been recorded (Glushchenko et al., 1995). Later, there was an increase in the number, which reached about 14 pairs in the 1990s (Glushchenko and Mrikot, 2000). Subsequently, the growth of the Khanka Lake population continued, and in 2018 its number reached a historical maximum of 88 residential nests (Surmach et al., 2022), which exceeded the historical minimum of 1987 by almost 18 times. Against the background of population growth in the Khanka lowland, there was also some expansion of the nesting area, while storks nests were found for the first time including near the northwestern shore of Khanka Lake (Maslova et al., 2016), but these birds have not yet bred outside the Khanka basin, to the south of it. Even during seasonal migrations, Oriental Storks were known here from just several finds (Glushchenko and Korobov, 2023; Glushchenko et al., 2019; Nazarenko, 1971; Nazarenko et al., 2016; Omelko and Omelko, 1981; Panov, 1973).

However, in 2023, a residential nest of the Oriental Stork was discovered in the Razdolnaya River basin (Figs. 1, 2A). It was located on a power transmission tower 12 km northwest of the city of Ussuriysk and 5 km from the Razdolnaya riverbed. On June 26, 2023, there was one fledging nestling in it (Korobov et al., 2023). Thus, for the first time, a nest of the Oriental Stork was found south of the Khanka Lake basin. The nearest known nests are located in the basin of the Khanka Lake and are located 36 and 50 km (Fig. 1, marked with numbers 1 and 2) to the northeast of it. These nests are also built on power transmission towers in the Abramovka River basin (left tributary of the Ilistaya River, Khanka lowland, nest coordinates 1 – N 44°10'26" E 132°17'39", nest 2 – N 44°3'22" E 132°11'59"). However, nest 1 was not found in the spring of 2024. It may have fallen by itself or been dropped by electricians. Nest 2 is also apparently uninhabited. When it was examined on December 4, 2024, it was deformed from one edge and overgrown with weeds (our data). Thanks to this discovery, in 2024 we conducted a detailed survey of stork nesting sites to be found in the Razdolnaya River basin.

Materials and methods

In 2024, we conducted a search for nests of the Oriental Stork on high-voltage power lines in the Razdolnaya River basin (=Suifun River) within the Oktyabrsky and Mikhailovsky districts, as well as the Ussuriysk Urban District of Primorsky Krai, both during and after the breeding season. The nests found were marked on the GPS navigator Garmin GPSMAP 64st, each nest was photographed, and its position on the power transmission tower was noted. The data kindly provided by I.N. Dobrydin was also used, for which we express our sincere gratitude to him.

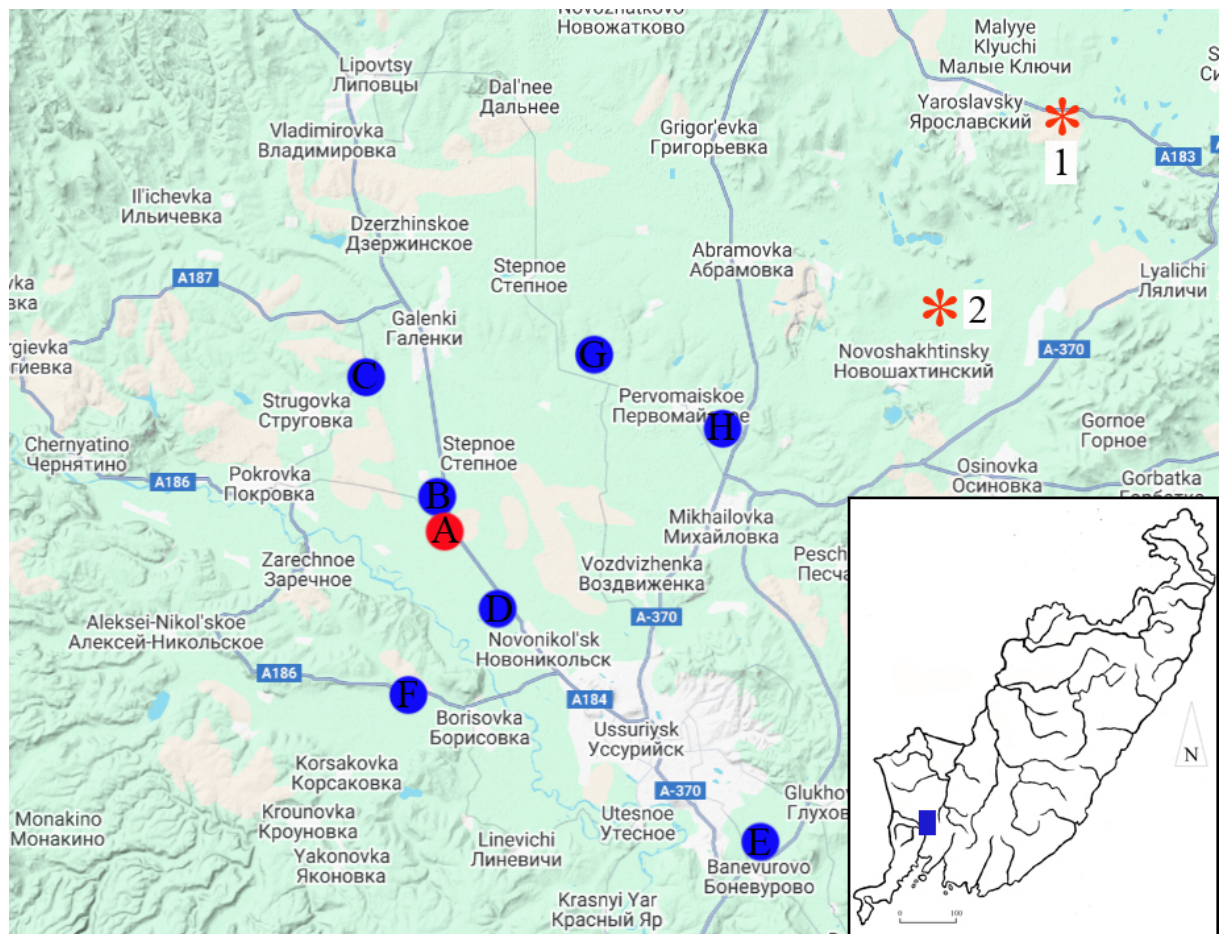


Fig. 1. The location of the nests of the Oriental Stork *Ciconia boyciana* in the Razdolnaya River basin (explanations in the text). The numbers indicate the nearest known nests in the Khanka Lake basin, and the nest found in 2023 is marked with a red marker. The inset shows the research area.

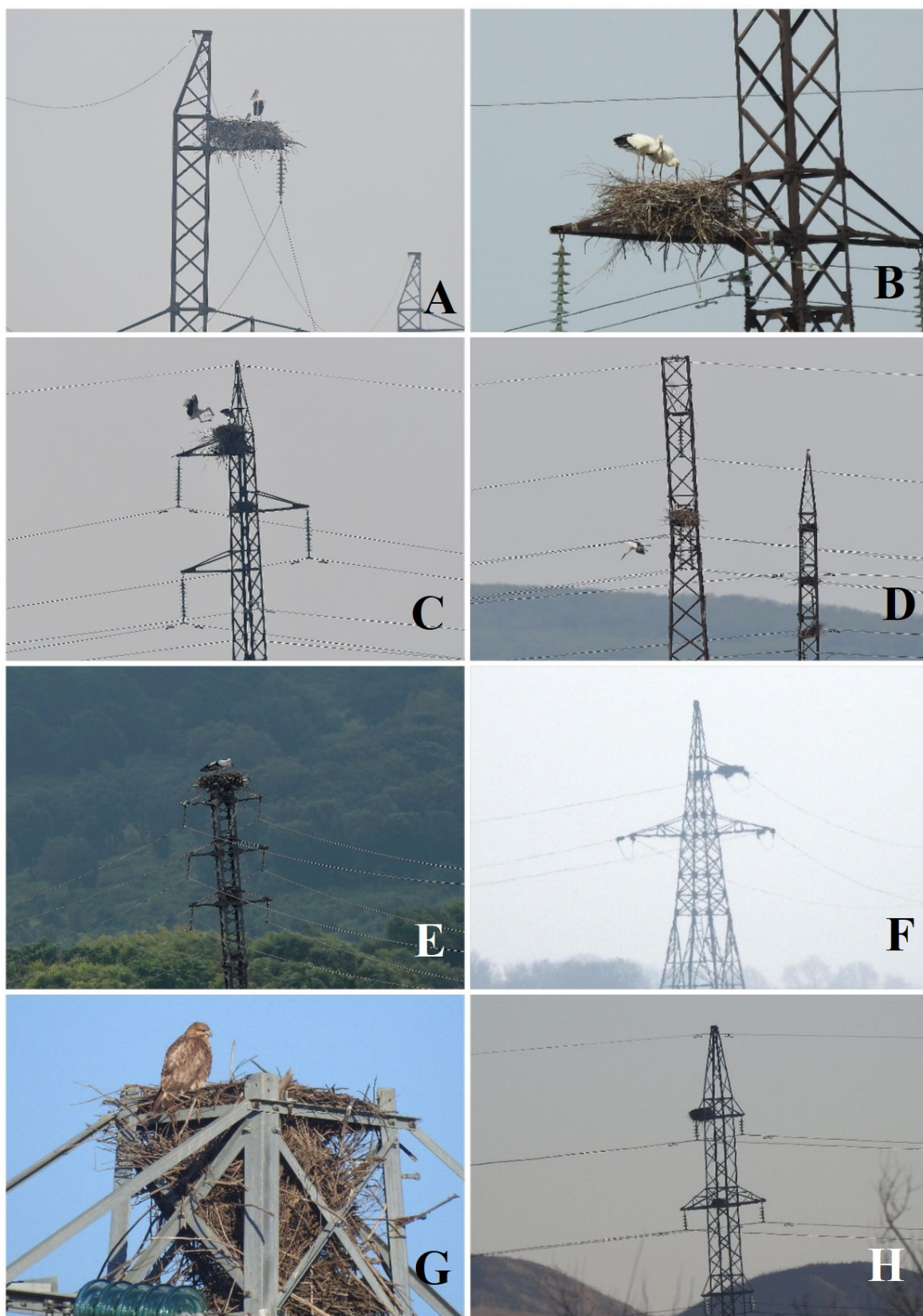


Fig. 2. Nests of the Oriental storks *Ciconia boyciana* in the Razdolnaya River basin: **A** – 28.04.2024, photo by D.V. Korobov; **B** – 23.04.2024, photo by D.A. Belyaev; **C** – 28.04.2024, photo by D.V. Korobov; **D** – 28.04.2024, photo by D.V. Korobov; **E** – 01.08.2024, photo by D.V. Korobov; **F** – 13.11.2024, photo by D.A. Belyaev; **G** – 01.12.2024, photo by D.A. Belyaev; **H** – 01.12.2024, photo by D.A. Belyaev.

Results

In 2024, we discovered seven more nests of this species, and Oriental Storks built at least five of them in 2024, as we had been actively working in their locations in previous years and had not seen them. All the nests found were also located on the power transmission towers. The first of them was found on April 12, 2024, 2 km northwest of the aforementioned nest A on the other side of the highway 05K-220 Ussuriysk–Pokrovka with coordinates N 43°56'6" E 131°46'34" (Figs. 1, 2B). The second nest was discovered on April 28, 10 km northwest in the floodplain of the Krestyanka River (left tributary of the Razdolnaya River) at coordinates N 44°0'43" E 131°42'38" (Figs. 1, 2C). It is located 3.5 km from the southwestern outskirts of the settlement of Galyonki, Oktyabrsky district. It should be noted that this nest is much larger than the other nests found in the Razdolnaya basin and may have appeared earlier than 2024. On the other hand, the large size may be just a consequence of the active nest-building behavior of a particular pair of storks. There is also a nest of the rook *Corvus frugilegus* L., 1758, on the support platform below the stork's nest. On the same day, we discovered a third nest with coordinates N 43°52'31" E 131°49'49" in the floodplain of the Slavyanka River (a left tributary of the Razdolnaya River) 6 km south of the first nest found (Figs. 1, 2D). It was located just 1.3 km northwest of the village of Novonikolsk in the Ussuriysk Urban District. The fourth nest was discovered on July 1, 23 km southeast of the aforementioned rather compact cluster of nests and 1.5 km from the Raduzhny housing estate of Ussuriysk in the floodplain of the Komarovka River (left tributary of the Razdolnaya River) with coordinates N 43°43'53" E 132°2'22" (Figs. 1, 2E). It was re-examined on August 1, 2024, and contained three nestlings ready for departure. Unlike the previous nests located at the ends or at the base of the traverse supports of power transmission towers, this one was located at the top of a rectangular metal tower. The fifth nest was found on November 13, 2024, in the floodplain of the Suglinka River (a second-order right tributary of the Razdolnaya River, coordinates N 43°49'24" E 131°44'46") almost 5 km northwest of the village of Borisovka in the Ussuriysky Urban District (Figs. 1, 2F). It was also located at the end of the traverse of the high-voltage power transmission tower. The sixth nest was found on November 12 near the highway 05K-182, 5.5 km northwest of the village of Pervomaiskoye, Mikhailovsky district, in the basin of the Repyevka River (a fourth-order left tributary of the Razdolnaya River, coordinates N 44°1'8" E 131°54'10") (Figs. 1, 2G). It was located on top of a rectangular cross-section of a metal power transmission tower, filling the upper section of the tower. There was an old rook's nest at the base of the stork's nest. It was re-examined on December 1, 2024. Both times, the eastern buzzard *Buteo (buteo) japonicus* Temminck et Schlegel, 1844, used the nest for resting. The seventh nest was discovered on December 1, 2024, 1 km northeast of the village of Novoe, Mikhailovsky district, near the highway A-182 Ussuriysk–Khorol in the basin of the Mikhailovka River (left tributary of the fourth order of the Razdolnaya River, coordinates N 43°58'52" E 132°1'3") (Figs. 1, 2H). It was located on the traverse of a high-voltage power tower and is located just 17 km from nest 2 in the Khanka Lake basin.

The nests found are located in a leveled landscape, with low hills and uplands. Small rivers with slow currents, swampy valleys, cut through reclamation canals, as well as numerous small lakes and reservoirs, are excellent feeding stations for storks. Numerous old trees and significant wetlands are also found in the nearby wide valley of the Razdolnaya River. The territory is mainly occupied by agricultural fields interspersed with forest belts running along highways and between fields, and consisting mainly of Siberian elm *Ulmus pumila* L. as well as secondary low-growing forests of Mongolian oak *Quercus mongolica* Fisch. ex Ledeb. and Asian black birch *Betula dahurica* Pall. on the slopes of hills and stands from willows *Salix* spp. along riverbeds (Fig. 3).

Discussion

Thus, we see that if in 2023 there was only a single case of nesting of the Oriental Stork outside the basin of the Khanka Lake, then, in addition to it, seven more nests that are new became known in 2024. Obviously, this trend towards range expansion will continue in the future. In the summer of 2025, we discovered a previously unknown nesting group of storks near the city of Arsenyev (Belyaev and Korobov, 2025). The increase in population and range expansion to the south of the Khanka Lake basin can be explained by several reasons. Firstly, it is the climatic factor. In different parts of the range of the Oriental Stork, it was noted that its abundance has a clear positive relationship with an increase in climate humidity (Kozhevnikova, 2009; Sasin and Senchik, 2011). In years rich in precipitation, aquatic

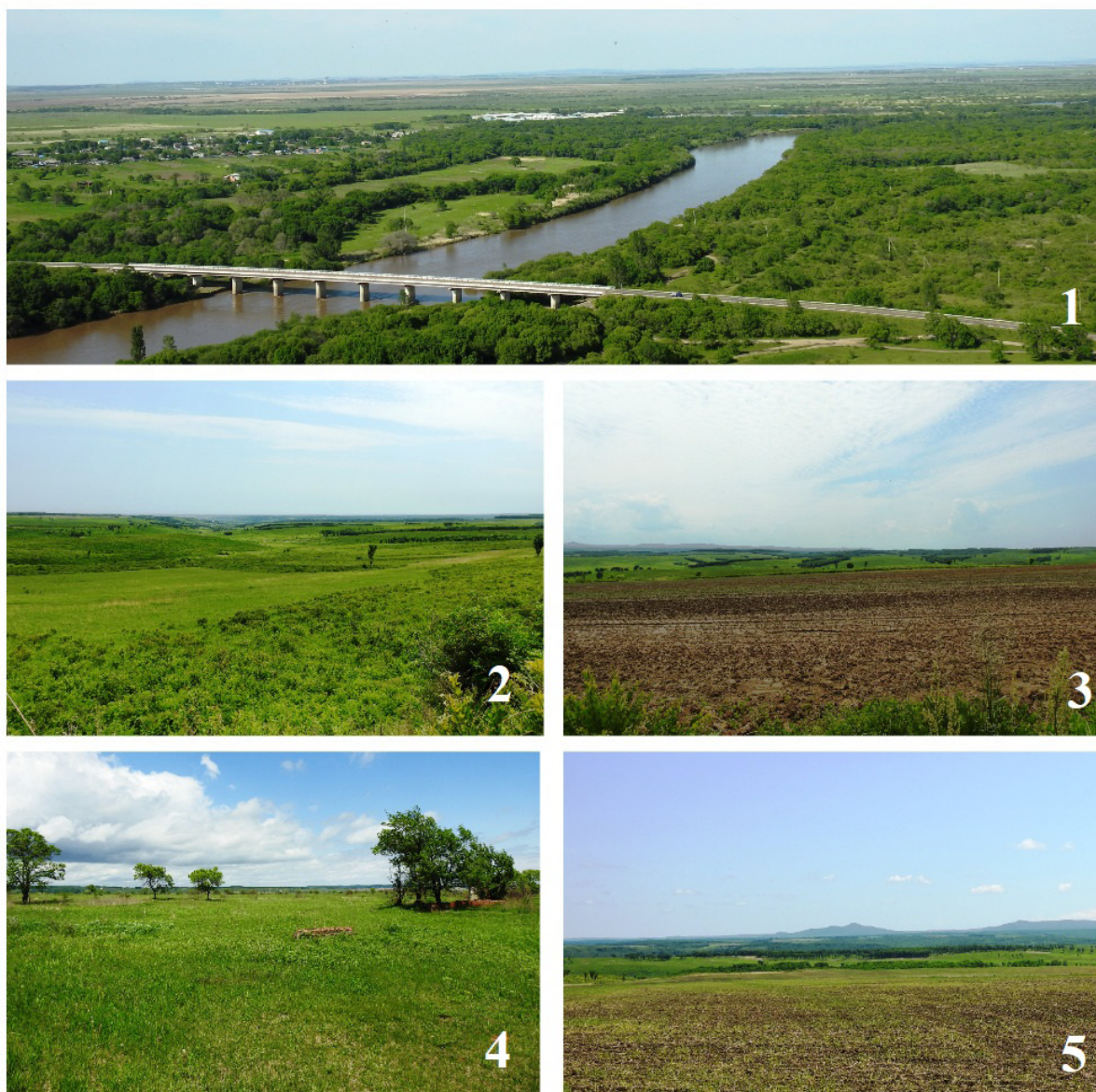


Fig. 3. Typical landscape in the Razdolnaya River basin: 1 – Razdolnaya River, near the settlement of Pokrovka (Oktyabrsky district, Primorsky Krai), 08.06.2022; 2 – outskirts of Aleksey-Nikolskoye village (Ussuriysk Urban District, Primorsky Krai), 15.06.2023; 3 – outskirts of Putsilovka village (Ussuriysk Urban District, Primorsky Krai), 15.06.2023; 4 – outskirts of Korsakovka village (Ussuriysk Urban District, Primorsky Krai), 03.06.2022; 5 – outskirts of the Putsilovka village (Ussuriysk Urban district, Primorsky Krai), 02.06.2024. Photo by D.A. Belyaev.

animals, amphibians and small fish, which serve as the basis of the Oriental Stork's diet, reproduce rapidly (Sasin and Senchik, 2011), and, accordingly, the breeding success of these birds increases. In wet years, the intensity of grass fires, which have an extremely negative effect on the success of the nesting of the Oriental Stork since they destroy their nesting trees, is also lower (Dugintsov, 2008, 2019; Pronkevich et al., 2014; Sasin and Senchik, 2011; our data). Indeed, according to the information portal "Weather and Climate"¹, in the south-west of Primorye, the current decade is characterized by increased precipitation compared to the period 1981–1990 during which the historical minimum number of the Oriental Stork in the Khanka Lake basin was recorded (Glushchenko and Mrikot, 2000). The average precipitation in 1981–1990 was 621 mm, and in the period 2013–2023 – 779 mm, that is 1.2 times higher.

Another reason for the increase in the number of the Oriental Stork in the Khanka lowland was the change in the intensity of agriculture. Agricultural development of the territory affects this species in different ways. On the one hand, the stagnation of the agricultural sector in the 1990s contributed to the growth of its population. At that time, the reclamation drainage of the swampy parts of the Khanka lowland stopped, the anxiety factor decreased, many field roads became impassable and agricultural grass fires became rarer. At the same time, the Khankaisky State Natural Biosphere Reserve was established, which played a crucial role in preserving the Oriental Stork in the southwest of Primorsky Krai (Glushchenko and Mrikot, 2000). On the other hand, small reservoirs for economic and recreational purposes were created on agricultural lands in the 1970s, which significantly improved the feeding conditions for the Oriental Stork (Dugintsov, 2019). Mowing grass and harvesting crops also improve the availability of food for storks, making the search for frogs and rodents easier (Dugintsov, 2008), and the number of rodents on agricultural lands is usually higher than in natural habitats. However, the intensification of agriculture, as well as the introduction of soybean monoculture, also leads to pollution of adjacent reservoirs with heavy metals and pesticides that enter there with rain and soil waters, which negatively affects the well-being of storks (Averin, 2020; Pakusina et al., 2024).

Another reason that made it possible to increase the number of the Oriental Stork and expand it into new territories was the synanthropization of the species. Unlike the European white stork *Ciconia ciconia* L., 1758, the Oriental Stork initially shunned humans and avoided anthropogenic transformed habitats (Dugintsov, 2019; Glushchenko and Mrikot, 2000; Leonovich and Nikolaevsky, 1976; Shulpin, 1936). Since the 1970s, Oriental Storks began to penetrate in developed landscapes and begun to nest on artificial structures – power transmission towers, geodetic marks and non-residential buildings, and the process began to occur around the same time in different parts of the habitat of this species (Dugintsov, 2019; Glushchenko, 1985; Glushchenko and Mrikot, 2000; Kozhevnikov, 2009; Mikot and Mrikot, 2015).

Currently, in the Russian Far East, Oriental Storks tend to nest on power transmission towers in among an agricultural landscape (19–32% of nests) (Andronov and Andronova, 2021; Averin, 2020; Pronkevich et al., 2021; Sasin et al., 2021), and in the natural landscape (for example, on specially protected natural territories) prefer to build nests in trees (Dugintsov, 2019; Kozhevnikov, 2009). As a result, part of the population of the Oriental Stork has developed a number of behavioral, biological, and ecological features: habituation to a moderate background anxiety factor, secretive behavior of adult birds and nestlings in the nest, and the use of human economic activities (haymaking) to increase the efficiency of foraging (Dugintsov, 2008). Birds living in an agricultural landscape are tolerant of the presence of humans and domestic animals. They are quite tolerant of moderate background factors of anxiety: the work of agricultural machinery, moving cars, household and industrial noise in populated areas (Dugintsov, 2008).

Nesting on power transmission towers reflects the ecological plasticity of the species and creates significant potential for its further synanthropization, increase in numbers and expansion of the distribution range. The appearance of a breeding group of the Oriental Stork in the Razdolnaya River valley, in our opinion, is the result of the impact of a number of factors on the ecosystem of the Khanka-Razdolnaya plain. An increase in precipitation and an extreme rise in the water level in the Khanka Lake, which

¹ Weather and climate. Web page. URL: <http://www.pogodaiklimat.ru/history/319612.htm> (accessed: 29.11.2024).

exceeded its historical maximum in 2015 (Bortin and Gorchakov, 2016), and then decreased slightly, but is still significantly higher than the long-term average (Zuenko et al., 2020), which improved the food supply of the Oriental Stork. This, coupled with the functioning of the Khankaisky Nature Reserve, where birds had the opportunity to hatch their nestlings in the absence of a disturbance factor, better protection of nest trees from grass fires, and the installation of artificial supports for nesting (Glushchenko and Mrikot, 2000), led to a significant increase in the number of Oriental Storks. With a shortage of nesting trees (their number is currently rapidly decreasing because of the loss of stands due to flooding of the lowest sections of the Khanka basin) (Volkovskaya-Kurdyukova and Kurdyukov, 2024; our data) and artificial supports, a temporary "surplus" of the population began to look for new nesting sites, and the possibility of using power transmission towers allowed the stork to occupy previously inaccessible (due to the lack of substrates suitable for nesting) forage biotopes in the agricultural landscape, first in the Khanka lowland, and then expand further south, in the basin of the Razdolnaya River, where there are both suitable feeding stations for this species, as well as power transmission towers necessary for the construction of nests.

Since Oriental Storks are birds with pronounced nesting conservatism (Dugintsov, 2008), it is expected that in the future they will return to their nests from year to year, now located in the basin of the lower reaches of the Razdolnaya River in the territory of the Ussuriysky Urban District, Mikhailovsky and Oktyabrsky districts of Primorsky Krai, and young birds that have grown up here, they will also look for nesting sites nearby. It should be noted that in this territory there are at least several dozen power transmission towers suitable for nesting and located on or near the territory of successful biotopes for feeding. As observations in other parts of the stork's range show, these birds are able to nest next to each other. For example, in the Sheremetyevsky Nature Reserve in the Khabarovsk Krai, the minimum distance between neighboring nests is 20–25 m (Andronova et al., 2022), on Bolshoy Ussuriysky Island, pairs of storks nest on neighboring power transmission towers (170–340 m distance) (Adnagulov, 2023). Similar examples of "densification" of nesting pairs in the presence of suitable power transmission towers are also known from the Amur Region (Dugintsov, 2019). Moreover, having settled the lower reaches of Razdolnaya River (including the estuary part of the river, where there are no nests yet), Oriental Storks have the opportunity to settle in suitable habitats further south up to the village of Kraskino (Khasansky district), and, in the case of making special supports on which birds can nest, to settle a large wetland site "Tumangan", which (like the Razdolnaya River Delta) falls under a wetland of international importance according to the criteria adopted by the 7th Conference of the Parties to the Ramsar Convention, (Nechaev, 2005; Shibaev and Bersenev, 2005). It should be noted that the Khasansky Nature Park and the protected area of the Land of the Leopard National Park are located here, which can contribute to the protection of these birds.

It should be emphasized that the nesting of the Oriental Storks on the power transmission towers caused a negative reaction from power engineers. It is necessary to resolve the issue with the companies servicing the electric grid in the near future, since their employees periodically reset the nests of Oriental Storks during the repair of power lines (Dugintsov, 2008, 2019; Mrikot and Mrikot, 2015). There is a Conservation Strategy of the Oriental Stork in the Russian Federation², approved by the Federal Ministry of Natural Resources and Ecology, which explicitly states the need for optimal resolution of conflict situations related to the nesting of Oriental Storks on power transmission towers. There are ways to solve this problem (the installation of special platforms on power transmission towers that prevent the nest from contacting the current-carrying wires, "distracting" wildlife management in the form of installing artificial nest supports in places where storks nesting on power lines is undesirable, etc.) and are successfully used, for example, in the Amur region (Dugintsov, 2008; Sasin et al., 2021). Such experience should be implemented in Primorsky Krai. The existing methods of preventing storks from nesting on power transmission towers in the form of installing devices to prevent nesting ("hedgehogs") are not always effective (Fig. 4).

² Decree of the Minister of Natural Resources and Ecology of the Russian Federation dated 08.12.2021 No. 52-r "On the approval of the Conservation Strategy of the Oriental Stork in the Russian Federation".

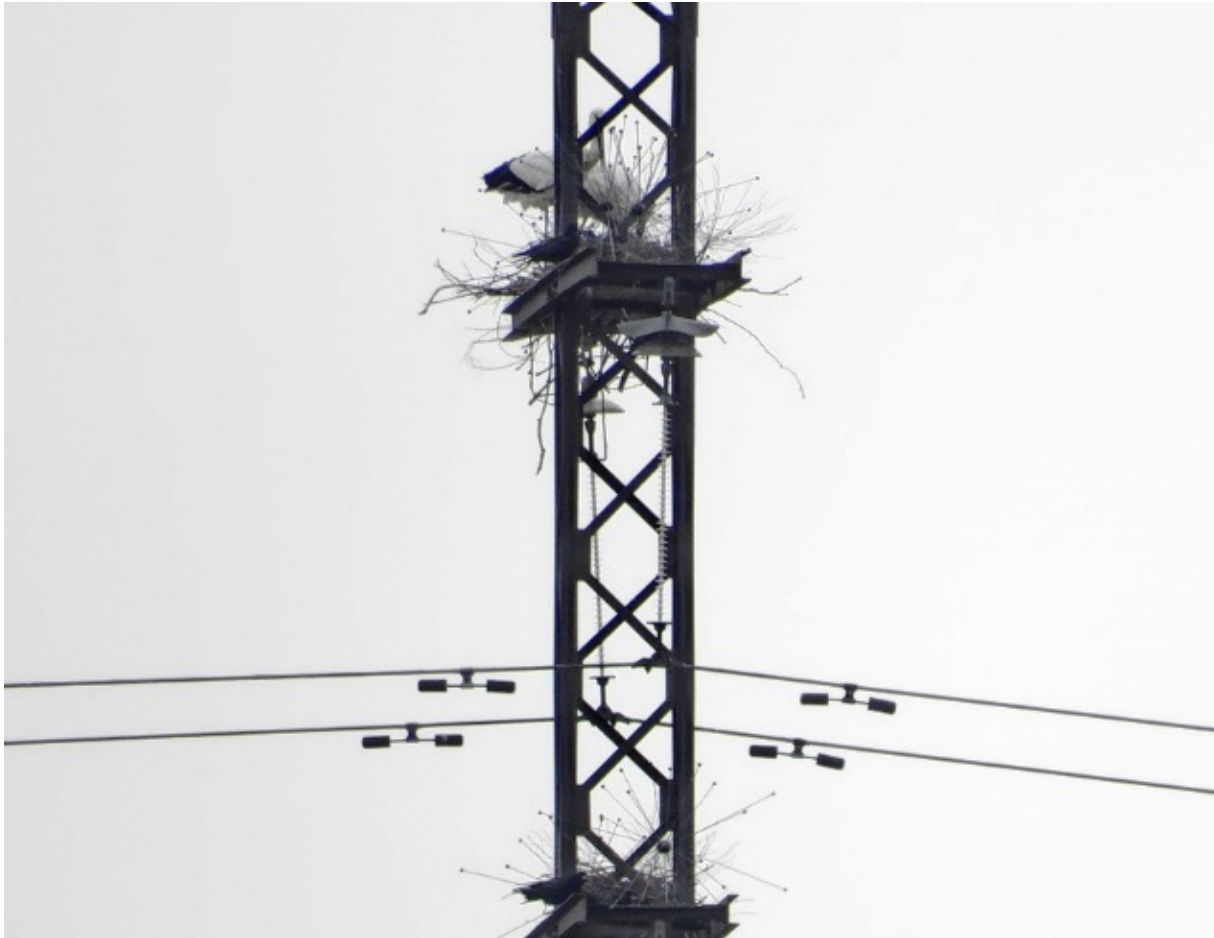


Fig. 4. The nest of the Oriental stork *Ciconia boyciana*, arranged on a traverse with devices to prevent nesting. The outskirts of Dmitrievka village, Chernigovskiy district, Primorsky Krai, 31.03.2024. Photo by I.A. Malykina.

Conclusion

Thus, we are currently witnessing the process of expanding the range of the Oriental Stork to the south, into the Razdolnaya River basin. Apparently, this is because of several reasons: an increase in precipitation over the past decade, an unprecedented increase in the water level in the Khanka Lake, the ecological plasticity of the storks themselves and their consistent synanthropization, namely, increased tolerance to human activity and the ability to master the supports of high-voltage power lines as a basis for nest placement. Unfortunately, nesting on power lines leads to conflict situations with electric grid companies, which must be resolved immediately, taking into account the status of the Oriental Stork as an endangered species listed in the Red Data Books of various levels. If there is good will on the part of the power engineers, these rare birds will be able to significantly increase their numbers and expand their breeding range, settling down to the lower reaches of the Razdolnaya River and even further south to the Khasansky district, where there are all conditions for this.

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