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Results of national White Stork *(Ciconia ciconia)* census in Hungary in 2019

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Abstract A national White Stork *(Ciconia ciconia)* census was organised in Hungary in 2019. The 14th country-wide nest count was coordinated by MME/BirdLife Hungary, also involving local branches and volunteers of the society and national park directorates.

Altogether 5,018 nests and 2,358 White Stork nest holders without nest material were reported. 89.2% of occupied nests were built on electric poles. Although 80 years ago every third nests were found on trees, in 2019, only 6 were reported at that location. Successful pairs raised 2.62 nestlings on average, breeding success for all breeding pairs was 2.19, which is lower than typical, probably due to chilly and rainy weather during the breeding season. Based on 3,540 reported breeding pairs and former census data, the White Stork population of Hungary is estimated to be 3,860–4,020 pairs in 2019. The size of the population was ca. 15–16 thousand pairs in 1941, which halved by 1958 and decreased to 5 thousand pairs by the late 1960s. For four decades, the population fluctuated between 4,800 and 5,500 pairs but in the last twenty years, the number of breeding pairs slightly decreased in the country. The population decline is stronger in hilly areas of W Hungary, i.e. in Somogy, Vas and Zala counties is about 60%.

Keywords: White Stork, national census, breeding population, decrease

Összefoglalás 2019-ben zajlott le a 14. országos fehér gólya felmérés, amelyet a Magyar Madártani és Természetvédelmi Egyesület (MME) szervezett a helyi csoportjai és egyes nemzetipark-igazgatóságok bevonásával. Összesen 5018 fészekről és 2358 fészekanyag nélküli üres fészektartóról küldtek jelentést a felmérők. A fészkek többsége (89,2%) villanyoszlopon épült. Bár nyolcvan éve még a fészkek harmada fán volt, 2019-ben már csak 6 db lakott fészket találtak ilyen helyen. Az átlagos fiókaszám az összes költőpárra számolva 2,19, a sikeres párokra számolva 2,62 volt. Ez a jellemző értéknél alacsonyabb költési siker valószínűleg a hűvös, esős május-júniusi időjárásnak köszönhető.

A jelentésekben szereplő 3540 fészkelő pár és a korábbi cenzusok adatainak összevetésével a teljes hazai költőállományt 3860–4020 pár közé becsüljük. Az állomány 1941-ben 15–16 000 pár lehetett, ami 1958-ra megfeleződött, az 1960-as évek végére pedig még tovább, 5000 pár körülire csökkent. Négy évtizedig 4800 és 5500 pár között fluktuált a fészkelő párok száma, de az elmúlt két évtizedben ismét csökkenést tapasztalhattunk. Ez a csökkenés Nyugat-Magyarország dombvidékein, Somogy, Vas és Zala megyében a legerősebb, akár 60% is lehet.

Kulcsszavak: fehér gólya, országos felmérés, költőállomány, csökkenés

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Introduction

The 14th national White Stork *(Ciconia ciconia)* census was organised in Hungary after 1941, 1958, 1963, 1968, 1974, 1979, 1984, 1989, 1994, 1999, 2004, 2009 and 2014. Former national census results were published by Homonnay (1964), Marián (1962, 1968, 1971), Jakab (1978, 1985, 1987, 1991), Lovászi (1998, 2004) and Lovászi *et al.* (2013, 2016). The White Stork population was estimated to be 15–16 thousand pairs in 1941, which halved by 1958. After a further decrease the population stabilized by the late 1960s and fluctuated between 4,800 and 5,500 pairs. At the last census (2014), we found 4,750–4,950 breeding pairs but strong decrease was detected in West Hungary. Results of regional censuses in the intervening years suggest that this decline is a long-term process and not only a fluctuation of the population as in the last decades. A country-wide nest count was able to answer if the population still stable (fluctuating) or decreasing in total.

Materials and methods

The census was organised by MME/BirdLife Hungary involving volunteers and national park directorate workers. Nest count was locally organised by county level coordinators, mainly local MME/BirdLife Hungary Groups.

Participants collected the following data of nests and nesting sites: locality (settlement, address, coordinates), nest features (nest holder base, type of electric pole, thickness of the nest, existence and condition of nest holder), occupancy, breeding success (number of nestlings), other information (dangerous electric poles, mortality cases, remarks).

Data were uploaded to the online stork database of MME Monitoring Centre (www.golya.mme.hu).

Data were summarized for counties and settlements. As we had no data for all settlements, missing values were imputed for each settlement to estimate the whole population, based on former census data of given settlement and regional trends.

Results

The online White Stork database included 12,963 nesting places (nests and metal nest-holders without nest material) at 23rd of February 2020, from which 1,869 was eliminated before 2019, 89 in 2019. The remaining 11,005 locality included 3,907 nesting places (metal nest holder facility) without nest material and 7,098 nests. Data were sent on 2,358 nesting places and 5,018 nests.

Most of the nests were occupied on electric poles (83.7%) or other poles independent from the electric network (8.8%). Buildings held 6.2% of nests, trees only 0.2% and other sites 0.9% *(Figure 1, Table 1)*. Other sites were concrete wall (1), wood pile (1), well-pole (1), loudspeaker pole (1), church (1), castle ruin (1), water tank (1), ventilation chimney (2), aviary (4), grain silo (6), and siren pole (12).

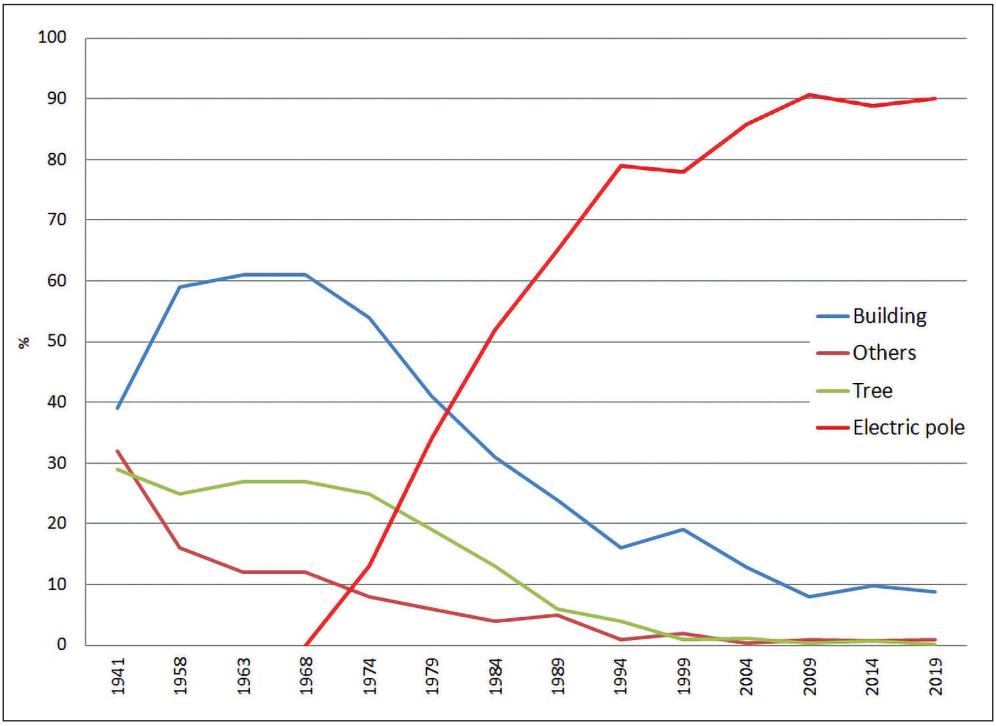

Figure 1. Changes of White Stork nest basements, 1941–2019
1. ábra Fészekaljzatok változása, 1941–2019

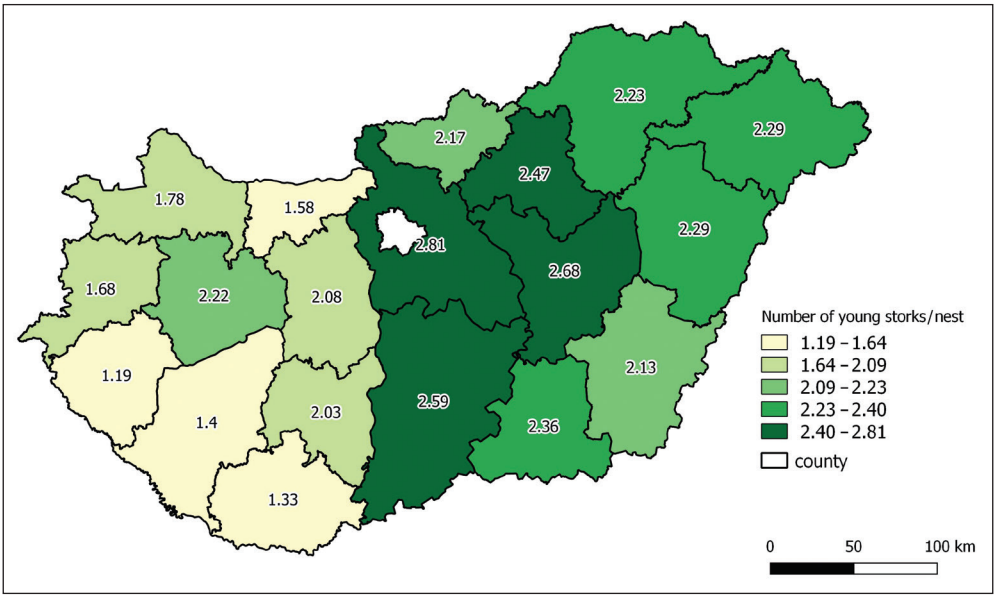

Figure 2. Average number of nestlings/nest (JZa) in counties
2. ábra Átlagos fészkenkénti fiókaszám megyénkénti megoszlása

Table 1. Reported nest basements: occupied nests (unoccupied nests)
1. táblázat Lejelentett fészekaljzatok megoszlása: foglalt fészkek (lakatlan fészkek)

County	Electric pole without holder	El. pole with nest holder	El. pole (nest holder unk.)	Other pole, pylon	Building (roof, chimney, tower)	Factory chimney, boiler house chimney	Water tower	Tree	Others	Total	Total
Bács-Kiskun	51 (11)	215 (44)	6 (1)	22 (8)	13 (6)	9 (1)	2 (1)	2 (-)	2 (-)	322 (72)	394
Baranya	21 (5)	131 (31)	3 (2)	5 (3)	11 (4)	15 (2)	- (-)	- (-)	4 (1)	190 (48)	238
Békés	22 (17)	175 (101)	- (-)	7 (4)	14 (4)	51 (9)	- (1)	- (1)	1 (1)	270 (138)	408
Borsod-Abaúj-Zemplén	43 (38)	343 (219)	3 (-)	16 (9)	10 (7)	15 (12)	- (-)	- (1)	- (-)	430 (286)	716
Csongrád	61 (15)	154 (55)	4 (2)	15 (9)	6 (4)	12 (2)	1 (-)	- (-)	1 (3)	254 (90)	344
Fejér	9 (3)	79 (31)	1 (-)	21 (16)	3 (-)	6 (1)	- (-)	- (-)	1 (1)	120 (52)	172
Győr-Moson-Sopron	22 (5)	85 (22)	3 (-)	10 (0)	12 (-)	10 (1)	- (-)	- (-)	3 (-)	145 (28)	173
Hajdú-Bihar	26 (12)	512 (156)	1 (-)	28 (12)	9 (2)	17 (4)	1 (1)	2 (-)	7 (2)	603 (189)	792
Heves	1 (-)	15 (-)	- (-)	1 (-)	- (-)	- (-)	1 (-)	- (-)	1 (-)	19 (-)	19
Jász-Nagykun-Szolnok	24 (9)	115 (44)	3 (-)	5 (7)	4 (2)	17 (1)	1 (1)	1 (3)	6 (1)	176 (68)	244
Komárom-Esztergom	4 (2)	14 (5)	- (-)	- (5)	1 (-)	1 (1)	- (-)	- (-)	- (-)	20 (13)	33
Nógrád	2 (9)	53 (8)	- (-)	6 (2)	- (-)	10 (2)	- (-)	- (-)	2 (-)	73 (21)	94
Pest	18 (12)	45 (16)	- (1)	4 (4)	4 (4)	2 (-)	3 (-)	- (-)	- (-)	76 (37)	113
Somogy	3 (3)	16 (11)	- (-)	1 (-)	- (-)	1 (-)	- (-)	- (-)	1 (-)	22 (14)	36
Szabolcs-Szatmár-Bereg	62 (14)	358 (86)	1 (1)	30 (18)	9 (5)	2 (1)	1 (-)	1 (-)	3 (-)	467 (125)	592
Tolna	20 (11)	56 (42)	4 (3)	11 (12)	6 (3)	3 (-)	1 (-)	- (-)	1 (1)	102 (72)	174
Vas	12 (4)	78 (41)	- (-)	19 (9)	14 (13)	9 (4)	- (-)	- (-)	- (-)	132 (71)	203
Veszprém	10 (4)	74 (32)	1 (-)	6 (5)	8 (2)	2 (-)	- (-)	- (-)	- (1)	101 (44)	145
Zala	13 (3)	76 (20)	1 (1)	9 (3)	- (-)	1 (-)	- (-)	- (-)	- (1)	100 (28)	128
Total	424 (177)	2594 (964)	31 (11)	216 (126)	124 (56)	183 (41)	11 (4)	6 (5)	33 (12)	3622 (1396)	5018
Total	601	3558	42	342	180	224	15	11	45	5018	

Table 2. Breeding results (HO: unoccupied nest, HE: lonely stork, HPo: unsuccessful pair without fledged nestling, HPm: successful pair, HPa: all breeding pairs)

2. táblázat Költési eredmények (HO: lakatlan fészek, HE: magányos gólya, HPo: sikertelen pár kirepült fióka nélkül, HPm: sikeres pár, HPa: összes költőpár)

County	Empty nest holder	Nest attempt	HO	HE	HPo	HPm	HPa – reported	HPa – total estimated
Bács-Kiskun	44	3	69	6	39	277	316	346–366
Baranya			48	3	74	113	187	187
Békés	27		138	7	49	214	263	263
Borsod-Abaúj-Zemplén	393	26	260	4	83	343	426	470–500
Csongrád	102	2	88	6	36	212	248	248
Fejér	126		52	1	19	100	119	119
Győr-Moson-Sopron	5		28	4	39	102	141	141
Hajdú-Bihar	611	3	186	22	40	541	581	589–610
Heves					1	18	19	60–90
Jász-Nagykun-Szolnok	146	5	63	2	15	159	174	220–270
Komárom-Esztergom	1		13	1	6	13	19	19
Nógrád	132	17	4	1	12	60	72	72
Pest	37	5	32	1	8	67	75	105–115
Somogy	14	5	9	2	8	12	20	120–200
Szabolcs-Szatmár-Bereg	455	7	118	8	72	387	459	489–494
Tolna	54		72	2	19	81	100	100
Vas	174		71	2	32	98	130	130–135
Veszprém	31		44	6	12	83	95	95
Zala	6		28	4	24	72	96	134–160
Total	**2358**	**73**	**1323**	**82**	**588**	**2952**	**3540**	**3907–4184**

Out of the 5,018 reported nest, there were 73 nest attempt (1.5%), 1,323 unoccupied nests (26.4%), 82 lonely White Stork (1.6%), 588 unsuccessful pairs (11.7%) and 2,952 successful pairs with nestlings (58.8%) *(Table 2)*.

Successful pairs typically raised 3 or 4 nestlings. Breeding success was 2.19, calculated for all pairs, 2.62 for successful pairs *(Table 3)*. Breeding success varied between 1.19 and 2.81 in certain counties *(Figure 2)*.

Most White Storks bred in NE Hungary (Borsod-Abaúj-Zemplén, Hajdú-Bihar and Szabolcs-Szatmár-Bereg counties), 1,550–1,600 pairs, which is about 40% of the country's population. The density is the highest near rivers (especially in the Upper Tisza valley) and around large wet or saline grasslands (like Hortobágy). White Storks do not breed in mountain areas (ca. 500 m above sea level), in the Budapest agglomeration and large monocultural plough lands *(Figure 3)*.

Table 3. Breeding success (JZG: total number of nestlings fledged, JZa:average number of nestlings for all nests, JZm: average number of nestlings for successful nests)

3. táblázat Költési siker (JZG: kirepült fiókák száma, JZa: összes költőpár fészkenkénti fiókaátlaga, JZm: sikeres párok fészkenkénti fiókaátlaga)

County	Number of nestlings					JZG	JZa	JZm
	1	2	3	4	5			
Bács-Kiskun	15	56	127	69	7	819	2.59	2.96
Baranya	34	34	33	12	-	249	1.33	2.20
Békés	32	63	68	48	1	559	2.13	2.61
Borsod-Abaúj-Zemplén	38	93	125	77	9	952	2.23	2.78
Csongrád	13	42	101	40	5	585	2.36	2.76
Fejér	13	31	44	10	-	247	2.08	2.47
Győr-Moson-Sopron	15	37	38	12	-	251	1.78	2.46
Hajdú-Bihar	22	82	146	154	18	1330	2.29	2.46
Heves	3	4	8	3	-	47	2.47	2.61
Jász-Nagykun-Szolnok	12	33	64	39	8	466	2.68	2.93
Komárom-Esztergom	3	4	5	1	-	30	1.58	2.31
Nógrád	10	18	18	14	-	156	2.17	2.60
Pest	2	10	31	19	4	211	2.81	3.15
Somogy	2	5	4	1	-	28	1.40	2.33
Szabolcs-Szatmár-Bereg	56	95	142	84	9	1053	2.29	2.72
Tolna	15	23	30	13	-	203	2.03	2.51
Vas	19	45	28	4	2	219	1.68	2.23
Veszprém	7	31	36	6	2	211	2.22	2.54
Zala	12	23	16	2	-	114	1.19	1.58
Total Hungary	**323**	**729**	**1064**	**608**	**65**	**7730**	**2.19**	**2.62**

More than 20 pairs occupied nest in Nádudvar (33), Hortobágy (30), Komádi (28), Egyek (27), Görbeháza (27), Berettyóújfalu (25), Sárospatak (25), Akasztó (24), Balmazújváros (24), Mezőcsát (23), Nagyiván (22), Szeghalom (21) settlements *(Figure 4)*.

Unlike Poland, where White Storks breed mainly in settlements with less than 100 thousand inhabitants (Kopij 2017), in Hungary, several cities has considerable population, like Nyíregyháza (12), Szeged (11) and Debrecen (10) cities. However, aggregation of White Storks around landfills reported from several countries (e.g. Bialas *et al.* 2020) was not reported yet from Hungary.

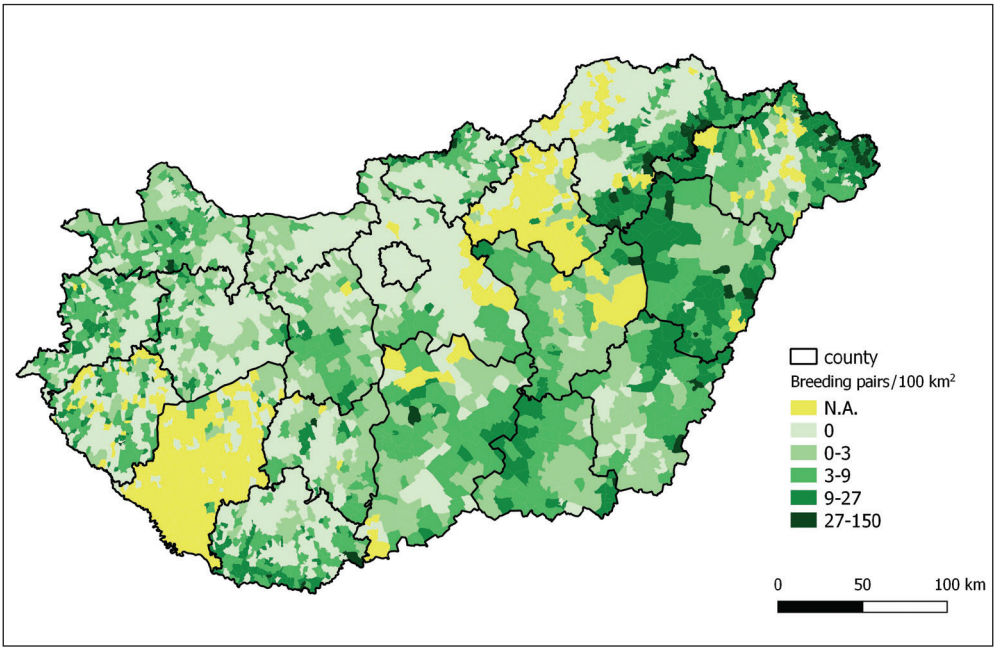

Figure 3. Density of breeding pairs for settlement's administrative boundaries (pair/100 km²)
3. ábra Költőpárok sűrűsége település közigazgatási határonként (pár/100 km²)

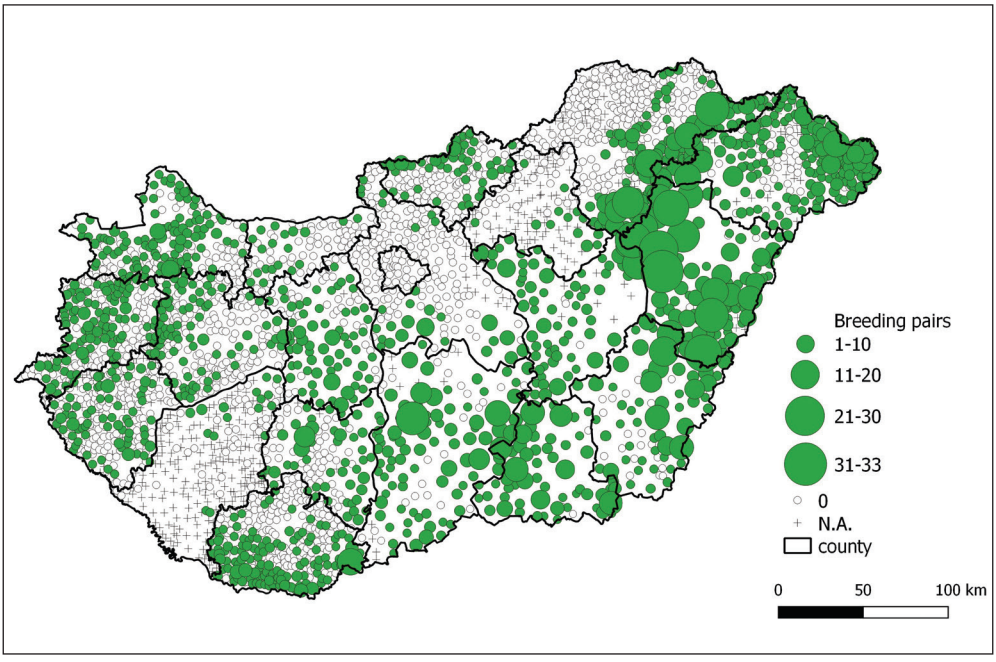

Figure 4. Number of breeding pairs in settlements
4. ábra Költőpárok száma településenként

Discussion

Breeding sites

First White Stork nests placed to electric poles were reported in 1968. Occupation of new nesting basement took place at the same rate in different parts of the country (Gyalus *et al.* 2018). By 1994, altogether 79% of nests were found on electric network or other pylons and it was amounted to a maximum of 90.6% in 2009. Almost the same number of nests were found on buildings and other places in the last 15 years but trees seems disappearing: while every 3rd nest were built on trees in the 1940s (Homonnay 1964), in 2019, only 6 were occupied by White Storks.

Breeding success

Breeding success varied between 1.58 and 3.09 since 1958 on a country-wide level, average was 2.34 nestlings for all breeding pairs. In 2019, only 2.19 young White Stork fledged from a nest on average due to frequent rains and colder temperature in May and June. The number of nestlings were lower in W Hungary (Baranya, Győr-Moson-Sopron, Komárom-Esztergom, Vas, Zala counties), where population loss is the highest. As new breeder, young birds tend to settle in the vicinity of their natal site (Chernetsov *et al.* 2006), further regional shrinking may occur.

Population changes

Although the eastern core populations (Poland, the Baltic States, Belarus, Ukraine) of White Storks counted more than 90 thousand and the southern (Iberian) population was 20 thousand breeding pairs in 2004 (Thomsen 2013), the much smaller Hungarian population is also a considerable part of the population of the species. The national population – similarly to other areas – suffered a significant loss in the 20th century.

The breeding site and habitat selection of the White Stork depends on suitable nest basements and feeding areas. The density is negatively influenced by several factors, like elevation, cover of shrublands and forests, and positively influenced by the presence of wetlands, grasslands, number of grazing animals (Carrascal *et al.* 1993, Wojciechowski & Janiszewski 2006, Tryjanowski *et al.* 2009, Radovic *et al.* 2015). In Hungary due to loss of traditional nest sites (wide chimneys, old trees, traditional hay stacks), loss and degradation of feeding sites (plowing grasslands, drainage, intensification), decrease of the population was caused. The decline of the population stopped when birds started to use electric poles as nesting sites (Lovászi 2013). From the 1970s, nature conservation and electric companies mounted hundreds of metal nest holders onto electric poles. As a result of this controversial help, 90% of White Storks mowed to electric poles. As standards of wiring change nowadays, new networks are built of isolated single cables instead of parallel uninsulated metal wires and older ones are also under change to following new standard, White Storks cannot built (or much more less) new nests to electric poles what can lead to further loss of pairs.

We do not know effect of climate change on breeding success. Weather of the Carpathian basin is influenced by Mediterranean, Atlantic and Continental climate zones, causing very variable temperature and rainfall distribution between years and seasons. Annual rainfall varies between about 400 and 800 mm, decreasing by 10% in the last hundred years (OMSZ 2020). These changes are unfavourable as White Storks primarily use wet or temporary wet grasslands, marshes. The national park directorates made several small and medium scale wetland revitalisations but these habitats hold only a small proportion of the population.

Above mentioned changes may adumbrate further loss of breeding White Stork population of Hungary. Unfortunately, actual population data are not available on international level. Latest reporting under Article 12 of the EU's Birds Directive provides national data from the 2008–2012 period (https://www.eionet.europa.eu/etcs/etc-bd/activities/reporting/article-12/art-12-reporting-2008-2012), also reporting decreasing population in neighbouring Austria and Slovakia.

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