THE CENSUS OF THE WHITE STORK (*Ciconia ciconia* Linnaeus, 1758) FROM ARGEŞ COUNTY, IN 2014

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Abstract. The situation of the white stork (*Ciconia ciconia* Linnaeus, 1758) breeding in Argeş County, in 2014, is showed in this paper. The data were collected during the White Stork Census in Romania, which was coordinated at the national level by the Romanian Ornithological Society, "Milvus Group" Bird and Nature Protection Association. It was focused on getting of information about the area, population size and breeding of the species in Romania. Some considerations regarding a number of indicators (uH, HPo, HPm, Hpa, H, JZG, JZa, JZm, and StD) that characterise the breeding as well as other facts about the distribution and the type of supports, where the nests were placed, are made. The results are compared with the ones obtained through the previous census of the white stork from Argeş County, carried on in 2004. Information of tendency type emerged. So, it was noticed that, although the number of the nests, the total number of the chicks, and the number of the localities with nests increased, the average number of chicks/nest decreased. A little decrease was also observed with regard to the average altitude the nest is placed. From the nest support point of view, an increasing of the number of nests installed on the artificial holders and a decreasing of the number of nests installed on the natural holders were remarked.

Keywords: white stork, breeding, Argeş, Romania.

Rezumat. **Recensământul berzelor albe (*Ciconia ciconia* Linnaeus, 1958) din judeţul Argeş, în 2014.** În această lucrare este prezentată situaţia cuibăritului berzei albe (*Ciconia ciconia* Linnaeus, 1758) în judeţul Argeş, la nivelul anului 2014. Datele au fost colectate cu ocazia realizării Recensământului berzei albe în România, recensământ coordonat în ţara noastră de Societatea Ornitologică Română şi Asociaţia pentru Protecţia Păsărilor şi a Naturii „Grupul Milvus". Acesta urmăreşte obţinerea de informaţii privind arealul, mărimea populaţiei şi cuibăritul speciei în România. Au fost consideraţi mai mulţi indicatori ai cuibăririi (uH, HPo, HPm, Hpa, H, JZG, JZa, JZm şi StD), dar şi alte date referitoare la distribuţia şi tipul suportului de amplasare a cuiburilor. Rezultatele sunt comparate cu cele obţinute la precedentul recensământ al berzelor albe din judeţul Argeş, realizat în 2004, reieşind unele informaţii tip tendinţă. Astfel, s-a constatat că, deşi numărul de cuiburi, numărul tuturor puilor şi numărul localităţilor cu cuiburi au crescut, media numărului de pui/cuib a scăzut. De asemenea, o mică descreştere a fost observată şi în privinţa mediei altitudinii locului de cuib. În ceea ce priveşte suportul cuibului, s-a remarcat o creştere a numărului de cuiburi instalate pe suporturi artificiale şi o scădere a numărului de cuiburi instalate pe suporturi naturale.

Cuvinte cheie: barza albă, cuibărire, Argeş, România.

INTRODUCTION

The white stork (*Ciconia ciconia* L.1758) breeding in Romania was discussed in many papers. These research-studies were performed mainly in Transylvania, Banat, Crişana and Maramureş – the South-Eastern part of Transylvania (KOVÁCS, 1968), the Western part of Romania (KISS, 1998), the Criş Rivers basin (BECZY, 1970), the Crişul Repede basin (IONCIO, 2004), the Târnava Rivers basin (KÓSA & PAPP, 2005), the Hârtibaciu River basin (KÓSA & PAPP, 2007), the Upper and Middle Olt River basin (KÓSA et al., 2002a), the Someş River basin (KÓSA et al., 2002b), the Burzenland, Hârtibaciu Valley and Târnavele Land (KLEMM, 1975a), the vicinities of the Harghita Mountains (WEBER & ANTAL, 1978), Satu Mare – Şieu – Măgheruş range (CRISTEA, 1993), Sibiu area (KLEMM, 1975b; PHILIPPI & POPA, 1990), Cluj area (BÉLDI, 1959, KÓSA et al., 1998a, b; KÓSA, 2015), Braşov County (LUTSCH, 1990; LUTSCH et al., 1990), Covasna County (DAMÓ, 1984, 1985; KOVÁCS, 1975, 1976; MOLNÁR, 1990), Timiş County (KISS, 1979, 1989, 1992, 2000), Mureş County (SÁRKÁNY-KISS & KÓNYA, 1991; PAPP, 1995; PAPP & SZABÓ, 1996), Harghita County (SZABÓ & PAP, 1996), etc. There are two papers dedicated especially to this subject from Moldavia and Bukovina (BALTAG & BOLBOACĂ, 2008; BALTAG et al., 2009), two from Oltenia (MUNTEANU, 1991; TĂNĂSESCU, 1993), one from Muntenia (MESTECĂNEANU et al., 2012) and three from Dobruja and the Danube Delta (KISS & MARINOV, 1990; MUTULICĂ & CAZACENCU, 1997; MESTECĂNEANU et al., 2014). There are few articles regarding the global situation, resulted from national censuses (KLEMM, 1982; SÁRKÁNY-KISS, 1990, 1991; WEBER, 1996; KÓSA, 2005, 2013 etc.). This is a succinct inventory, and an exhaustive writing on the theme presented into "The Fauna of Romania" (PETRESCU, 2015).

The white storks lay eggs in the first days of April. After an incubation of 31 – 34 days, the young hatch. They can fly after 33 – 35 days, when they are almost identical with the adults, except the darker bill and the undefined colour of the legs (RADU, 1984).

Except the North, it is a common species in Europe where there are 105,000 – 120,000 breeding pairs (ARAÚJO & BIBER, 1997) or 224,000-247,000 pairs, by IUCN, 2015 (http://www.iucnredlist.org). In Romania, it is broadly spread in rural localities and, also, in some towns, the number varying between 4,000 and 6,000 pairs (CIOCHIA, 1992; MUNTEANU et al., 2002) or 5,000 – 6,000 pairs (by Romanian Ornithological Society / BirdLife International, "Milvus Group" Bird and Nature Protection Association, 2015). However, in the Western and Central Europe a decline was noticed, because of modern agriculture, combined with the feeding habitat loss. The conditions from the winter quarters or from the migration routes (i.e. the long-term rainfall decreasing in the Western Sahel) may

also represent some reasons (ARAUJO & BIBER, 1997). By IUCN, it is Least Concern, the trend of the global population increasing (http://www.iucnredlist.org).

Taking these into account, the white stork is a protected species. In this regard, in Romania there are some laws: Law 13/1993 (http://biodiversitate.mmediu.ro), Law 13/1998 (http://www.legex.ro/), Law 462/2001 (http://legislatie.just.ro), and Law of hunting (http://agvps.ro). It is mentioned in the Red Book of the Romanian Vertebrates (MUNTEANU, 2005). Certain measures were applied, one of the most important being the supporting of the nests built on the top of the electrical poles with artificial platforms and the isolation of the wires against electric shock.

The goals of the present work were to establish the distribution of the white storks, to determine the number of breeding pairs and to obtain other information about the species breeding in Argeş County.

MATERIALS AND METHODS

Argeş County is one of the counties from the Southern part of Romania. Localised in Muntenia historical province, it is 6,826.3 km^2. Its relief is very diverse. In the North, there is Făgăraş Massif (East-West oriented) with many heights over 2000 m (Moldoveanu Peak, 2544 m, the highest), Piatra Craiului and Leaota Mountains, that totalise together 25% of the county area. They continue southwards with the Getic High Hills (the Subcarpathians) and Getic Piedmont (55% of the county area) – an ancient plain eroded by streams in narrow crests, composed of Cotmeana Piedmont, to the West (between the Olt and the Argeş Rivers), Argeş Piedmont, to the Centre (between the Argeş and the Argeşel Rivers), and Cândeşti Piedmont, to the East (between the Argeşel and the Dâmboviţa Rivers). To the South, there is the Romanian Plain, 20% of the county area (BARCO & NEDELCU, 1974, http://www.arges.insse.ro/main.php), where it is the lowest altitude of the county – 131 m, in the Cotmeana valley (Fig. 1).

The temperate-continental clime, with mountain character in the North and plain feature in the South, is beneficial to wild life (chiefly in the North, for the former, where the anthropogenic influence is lower) and humans. In the mountains, the snow is abundant and sometimes it can persist year round in the sheltered spaces. The annual average temperature is below 0°C and the average of the precipitations is over 1400 mm/year. In the hilly area, the clime is milder (the annual average temperatures are 6 – 9°C and the average ~~of~~ precipitation amount is 700 – 1000 mm/year). In the plain, the average of the annual temperatures is over 10°C and the average of the precipitations is below 700 mm/year (BARCO & NEDELCU, 1974). The year 2014, when this research was performed, has been one of the warmest years in Romania lately, because the annual air temperature average was 10.2°C (1.4°C bigger than the temperature average for 1961-2014). Also, it was a rainy year, with 807.7 l/m^2 (637.8 l/m^2, the mean for 1961-1990). The spring and the summer of 2014 were characterised by abundant precipitation amounts, mainly registered in short periods of time. So, by comparison with 1961-1990, generally, the months when the storks cover the eggs or raise the young were rainy: 83.2 mm – April (+31.7 mm), 115.8 mm – May (+40.1 mm), and 123.5 mm – July (+45.3 mm). Only June was a normal month: 88.8 mm (-0.4 mm), (SANDU, 2015).

Argeş County has a rich hydrographic system (Fig. 1). From West to East, it includes: the Topolog River (tributary to the Olt River), the Vedea River (including the Cotmeana and the Teleorman Rivers), the Argeş River (including the Vâlsan, the Râul Doamnei, with the Bratia, the Râul Târgului and the Argeşel, then the Cârcinov, the Neajlov, with the Dâmbovnic and the Glavacioc, and, finally, the Dâmboviţa River). The area of drainage of the Râul Doamnei is 1822 km^2, the surfaces of the other main hydrographical basins that overlap Ageş County area being unknown (UJVÁRI, 1972). There are numerous lakes: some of them are reservoirs (Vidraru – 870 ha, Vâlcele – 442 ha, Zigoneni – 165 ha, Vâlcele – 442 ha, Budeasa – 643 ha, Bascov – 140 ha and Goleşti – 680 ha, on the Argeş River, Pecineanu – 182 ha, on the Dâmboviţa River, and Râuşor – 190 ha, on the Râul Târgului), others, much smaller (below 2.2 ha), of natural origin: Învârtita, Buda, Capra, Călţun, etc. (the three latest in the mountain region). Also, there are many artificial ponds, from the submountain region to the plain one. The phreatic waters emerge to the surface mainly where the Getic Piedmont meets the Romanian Plain and, also, in Găvanu-Burdea Plain, the Southern subunit of the Romanian Plain (BARCO & NEDELCU, 1974; http://www.arges.insse.ro/main.php).

Because of the wide-ranging relief, Argeş County has a large biodiversity. The vegetation is gradually modified from the top of the mountains, covered by grasslands, to the plain, used for agriculture. The forests occur in the mountain, submountain and hilly area, where there are vast woodlands of spruce (*Picea abies*), beech (*Fagus sylvatica*), and oak (*Quercus* sp.). The arable land (about 30 % of the county) is cultivated with cereal plants: maize (*Zea mays*), wheat (*Triticum* sp.), oat (*Avena sativa*), barley (*Hordeum vulgare*), forage: alfalfa (*Medicago sativa*), white clover (*Trifolium repens*), ryegrass (*Lolium perene*) and edible plants: cabbage (*Brassica oleracea*), potato (*Solanum tuberosum*), onion (*Allium cepa*), etc. (ALEXIU, 2011). Moreover, there are many species of animals, some of them being food for the storks: insects, molluscs, fish, frogs, snakes, young and unfledged birds, mice, etc. They are caught often in short vegetation (CIOCHIA, 1992).

The number of localities from Argeş County is 102: three municipalities, four cities and 95 villages (Fig. 1, Fig. 2) and the population density is 89.7 inhabitants/km^2 (cf. http://www.arges.insse.ro).

The census was performed between July 1 and 31, 2014. It was part of the 7th International White Stork Census that was achieved in all European countries in 2014-2015. The Ornithological Romanian Society, the Milvus Group for the Birds and Nature Protection carried it out through the project "Sistemul naţional de gestiune si monitorizare a speciilor de păsări din România în baza articolului 12 din Directiva Păsări" – ***SMIS-CSNR 36586***, which was

implemented in Romania by the National Centre for Sustainable Development, Bucharest in partnership with the Ministry of Environment, Water and Forests (http://monitorizareapasarilor.cndd.ro).

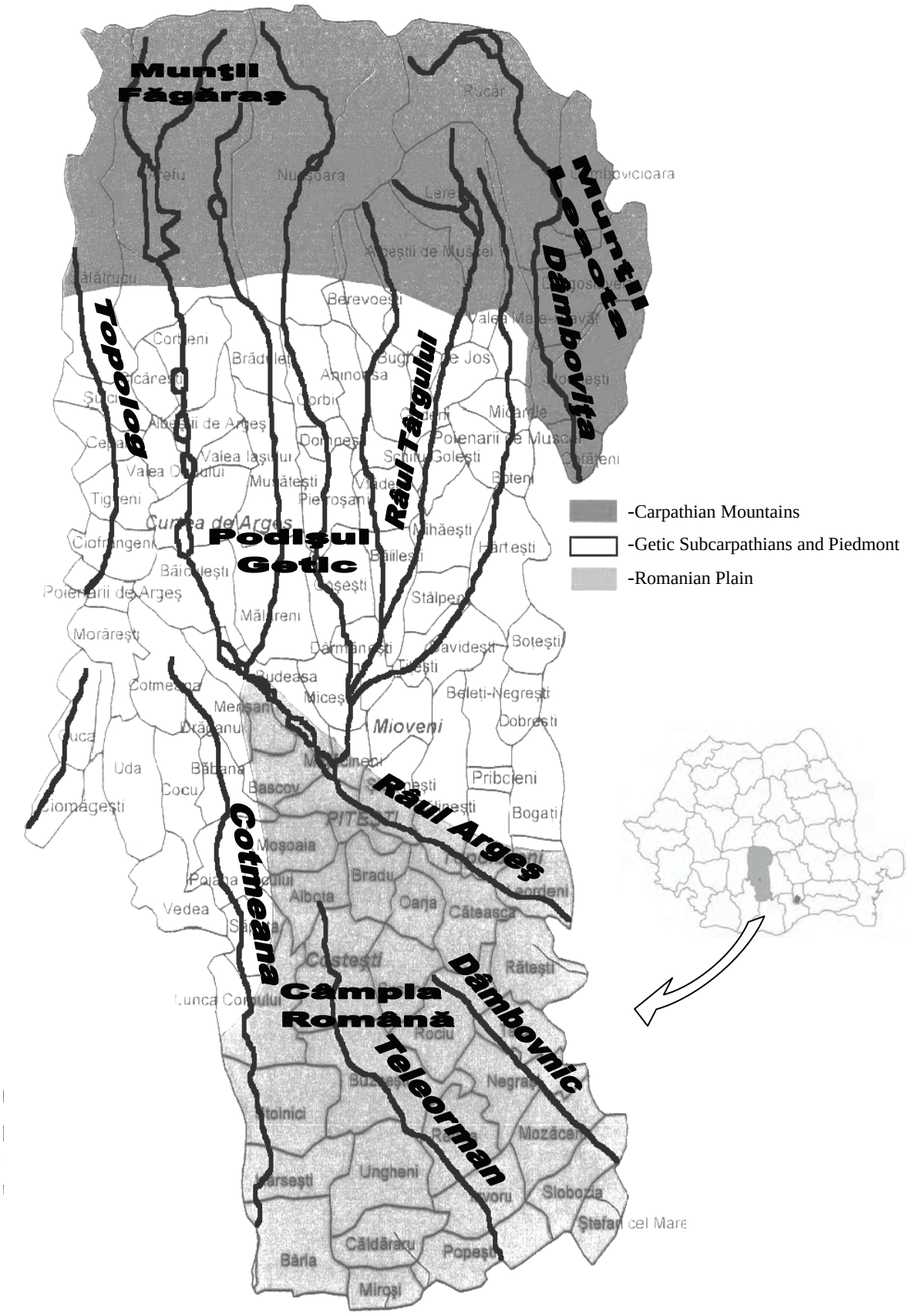

Figure 1. The administrative and physical map of Argeş County
(original map – www.arges.insse.ro/main.php, modified).

We verified in the field all the localities from Argeş County using cars. For supplementary information, the locals were questioned about the presence of the storks in their location.

A form which included each locality, the geographic coordinates of the nests, the altitude, the status of occupancy of the nest (pair with chicks, pair without chicks, solitary bird, unoccupied nest), the number of chicks, the placement of the nest (electric pole, chimney, stabling or barn, comb, tree), and the date of the observation was completed. Every nest was photographed. Also, the followed route was registered using a GPS device in conformity with the standard methodology (cf. http://www.ciconia.ro).

The recorded or calculated parameters are: uH – the number of unoccupied nests; HPo – the number of unsuccessfully breeding pairs; HPm – the number of successfully breeding pairs; HPa – the number of breeding pairs; H – the number of nests; JZG – the number of chicks; JZa – the average of the number of fledged young per pair related to all number of pair (nests with pair) of a defined area (JZG/HPa); JZm – the average of the number of fledged young per pair related to all number of nests bearing chicks of a defined area (JZG/HPm); StD – the number of pairs (HPa) per 100 km^2 of a defined area.

RESULTS AND DISCUSSIONS

In Argeş County, 74 nests (H) of white stork were counted (Table 1). They were found in 40 localities (39.21% of all localities of Argeş County), (Fig. 2): 2 municipalities (1.96%, Curtea de Argeş, Câmpulung), 2 cities (1.96%, Costeşti, Ştefăneşti) and 36 villages (35.29%, the rest of them). 62 localities (60.78% of all, Albeştii de Argeş, Albeştii de Muscel, Albota, Arefu, Băbana, Băiculeşti, Bălileşti, Bascov, Beleţi-Negreşti, Bogaţi, Boteni, Boţeşti, Brăduleţ, Bughea de Jos, Bughea de Sus, Călineşti, Cepari, Cetăţeni, Cicăneşti, Ciomăgeşti, Cocu, Cotmeana, Cuca, Davideşti, Dâmbovicioara, Dobreşti, Drăganu, Godeni, Hârseşti, Hârtieşti, Izvoru, Leordeni, Lereşti, Mărăcineni, Micesti, Mioarele, Mioveni, Morăreşti, Moşoaia, Mozăceni, Muşătesti, Nucşoara, Piteşti, Poiana Lacului, Poienarii de Argeş, Poienarii de Muscel, Priboieni, Râca, Rucăr, Sălătrucu, Săpata, Stâlpeni, Stoeneşti, Suseni, Tigveni, Topoloveni, Uda, Valea Danului, Valea Iaşului, Valea Mare-Pravăţ, Vedea, Vulturesti) did not have nests. The number of nests/locality with nests varied between 1 and 7 (Fig. 3), so that 1-3 nests were counted in 35 localities (87.5%), 4-6 nests were counted in 4 localities (10.0%) and 7-9 nests were counted in 1 locality (2.5%). The mean of nests/locality with nests was 1.85 and the mean of nests/locality was 0.72. In Cluj County, the mean number of nests/locality was 1.36 (KÓSA, 2015). It is interesting that there are three big areas in the county where the nests were not found: the most part of Făgăraş, Iezer-Păpuşa, Piatra Craiului and Leaota Mountains in the North, of Cotmeana Piedmont in the West, and of Cândeşti Piedmont in the East (Table 1, Fig. 3). Generally, these are defined by o mixture of factors (big or medium elevations, large forests, absent or relatively scarce settlements, absent or small sized agricultural terrains, the rivers with low debit and the lack of other significant wetlands, the wet climate) that are important due to the

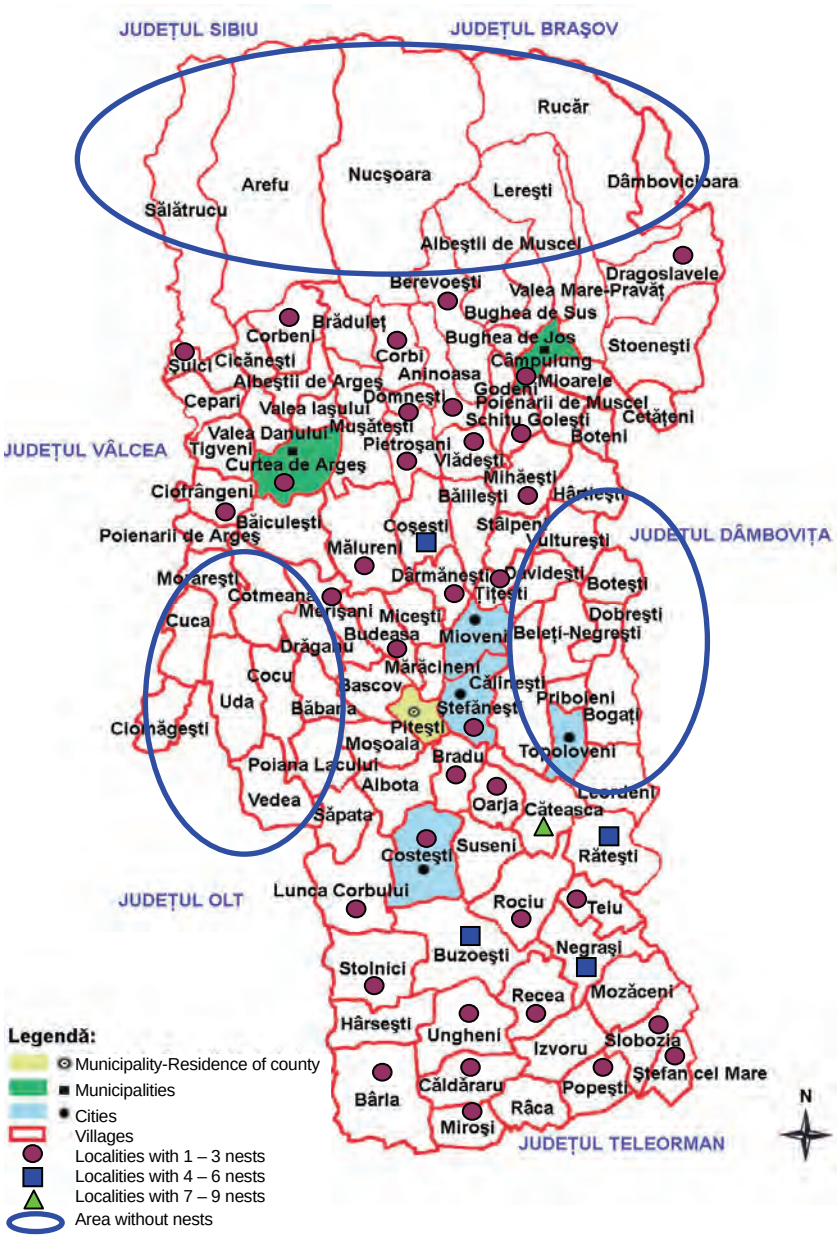

Figure 2. The distribution of the nests by localities (original map – www.arges.insse.ro/main.php, modified), (n=74).

favourable nest places and food resources assurance. Because there are some localities without nests in the plain area (Hârseşti, Izvoru, Mozăceni, Râca, and Suseni), other factors like the pollution and the chemistry of the water, the intensive agriculture etc. can be taken into discussion in the distribution, too. It is known that the monotonous crops on large scale decrease diversity of habitats and, consequently, the available preys for the birds (LOVÁSZI, 2012).

Table 1. The white stork breeding parameters by localities (n=74).

Parameter		Number of nests (H)	Pairs with chicks (HPm)	Pairs without chicks (HPo)	Number of pairs (HPa)	Solitary stork	Unoccupied nests (uH)	JZG	JZa	JZm	Nests on simple electric poles	Nests on electric poles with support for nest	Nests on chimneys	Nests on trees	StD	StD built-up area (- – unknown situation)
Localities	Aninoasa	2	1	0	1	0	1	3	3	3	1	0	0	0	1.74	16.58
	Bârla	2	2	0	2	0	0	7	3.5	3.5	1	1	0	0	1.93	16.23
	Berevoeşti	1	1	0	1	0	0	3	3	3	1	0	0	0	0.98	20.83
	Bradu	1	0	1	1	0	0	0	-	-	1	0	0	0	2.48	15.17
	Budeasa	2	2	0	2	0	0	6	3	3	1	0	0	0	4.73	-
	Buzoesti	4	3	1	4	0	0	9	2.25	3	2	0	0	0	2.50	17.96
	Căldăraru	2	1	0	1	0	1	2	2	2	1	0	0	0	8.55	-
	Cătеasca	7	5	1	6	0	1	17	2.83	3.4	1	1	0	0	1.66	-
	Câmpulung	1	1	0	1	0	0	2	2	2	0	0	1	1	7.36	100.00
	Ciofrângeni	1	1	0	1	0	0	3	3	3	2	1	1	1	2.31	14.53
	Corbeni	2	1	0	1	0	1	3	3	3	0	1	0	0	1.62	46.08
	Corbi	1	1	0	1	0	0	4	4	4	1	1	0	0	1.90	19.92
	Costeşti	1	1	0	1	0	0	4	4	4	1	0	0	0	1.10	6.39
	Coşeşti	5	2	1	3	0	2	7	2.33	3.5	1	0	0	0	4.89	36.59
	Curtea de Argeş	1	1	0	1	0	0	3	3	3	0	1	0	0	1.43	6.25
	Dârmăneşti	1	1	0	1	0	0	3	3	3	2	0	0	0	3.02	27.32
	Domneşti	2	1	0	1	0	1	3	3	3	0	1	0	0	5.04	20.04
	Dragoslavele	1	0	1	1	0	0	0	-	-	1	0	0	0	0.84	-
	Lunca Corbului	1	1	0	1	0	0	3	3	3	1	1	1	1	0.97	9.49
	Mălureni	1	1	0	1	0	0	4	4	4	2	0	2	2	0.93	5.35
	Merişani	1	1	0	1	0	0	3	3	3	1	0	0	0	6.90	21.98
	Mihăeşti	2	2	0	2	0	0	8	4	4	2	0	0	0	5.88	-
	Miroşi	1	0	1	1	0	0	0	-	-	2	0	0	0	2.08	16.61
	Negraşi	4	3	1	4	0	0	7	1.75	2.33	1	0	0	0	7.95	58.82
	Oarja	1	1	0	1	0	0	2	2	2	1	0	0	0	2.59	19.12
	Pietroşani	2	2	0	2	0	0	3	1.5	1.5	6	0	0	0	4.08	106.95
	Popeşti	2	2	0	2	0	0	6	3	3	1	0	0	0	3.64	76.92
	Răteşti	6	2	3	5	0	1	5	1	2.5	7	0	0	0	6.33	75.53
	Recea	1	1	0	1	0	0	4	4	4	1	0	0	0	1.58	-
	Rociu	3	2	1	3	0	0	7	2.33	3.5	3	2	0	0	3.77	34.68
	Schitu Goleşti	2	2	0	2	0	0	8	4	4	0	2	0	0	7.75	33.73
	Slobozia	1	1	0	1	0	0	5	5	5	2	0	0	0	1.61	8.64
	Stolnici	1	1	0	1	0	0	3	3	3	1	0	0	0	1.36	-
	Ştefan cel Mare	2	2	0	2	0	0	8	4	4	1	0	0	0	5.83	49.38
	Ştefăneşti	1	1	0	1	0	0	3	3	3	2	0	0	0	1.77	8.90
	Şuici	1	1	0	1	0	0	2	2	2	1	0	0	0	2.88	17.61
	Teiu	1	1	0	1	0	0	3	3	3	0	1	0	0	2.24	19.65
	Ţiţeşti	1	1	0	1	0	0	3	3	3	1	0	0	0	4.07	23.87
	Ungheni	1	1	0	1	0	0	2	2	2	1	0	0	0	1.33	16.67
	Vlădeşti	1	1	0	1	0	0	4	4	4	1	0	0	0	1.64	23.81
Total		**74**	**55**	**11**	**66**	**0**	**8**	**172**	**2.60**	**3.12**	**55**	**13**	**1**	**5**	2.71	21.95

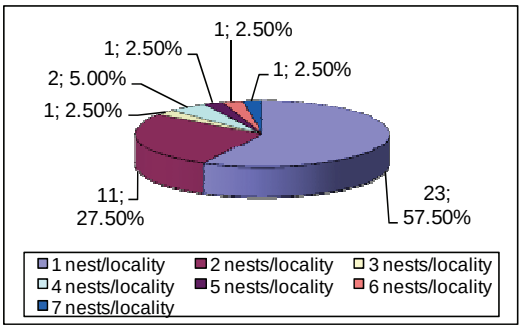

Figure 3. The distribution of the localities (%) by the number of nests (n=74).

Noticeable is the nest from Dragoslavele, locality situated in the mountain zone, between Iezer-Păpuşa, Piatra Craiului and Leaota Mountains, in front of Rucăr-Bran Mountain Corridor, where the small depression with the same name is crossed by the Dâmboviţa River (with a discharge over 4.4 m^3/s/year measured upstream, at Podu Dâmboviţei, cf. www.rowater.ro). Also, other nests are positioned in depressions: Corbeni (2 nests), Corbi (1 nest) and Câmpulung (1 nest) Submountain Depressions, and Curtea de Argeş (1 nest), Domneşti-Pietroşani (4 nests), Aninoasa-Valea Siliştii-Berevoeşti (3 nests) and Schitu Goleşti (2 nests) Intra-hilly Depressions. So, the total number of the nests located in depressions is 15 (20.27% of all number of nests from Argeş County). The nest from Şuici (on the Topolog Valley) is placed in the submountain region, so that Getic Subcarpathians totalize 15 nests (20.27%). In Cotmeana Piedmont there are only 2 nests (2.70% of all, one at Ciofrângeni, on the Topolog Valley, in the northern extremity of the area, and one at Merişani, in the Argeş Valley, at the contact with Argeş Piedmont). In Cândeşti Piedmont, there is only a nest (1.35% of all, at Ştefăneşti, on the Argeş Valley, at the contact with the Romanian Plain). The majority of the nests from the piedmont region were registered in Argeş Piedmont (13, 17.56% of all). As a result, in the Getic Piedmont there are 16 nests (21.62% of all). The biggest group was recorded in the Romanian Plain (Table 2).

About the hydrographical basins, most of the nests (56, 75.67% of all) were identified in the Argeş basin, where the Râul Doamnei, its principal feeder from the mountain and hilly area, had 21 nests (28.37% of all), (Table 2). 1 nest (1.35% of all) was identified in the Dâmboviţa basin.

The majority of the nests were situated between 200 and 299 m and the fewest were placed over 500 m altitude (Table 2). Function of relief, in other regions, the most numerous nests were found at 300 – 400 m altitude (Moldova, in 2007), the data from 2004, 2006 and 2007 showing an important distribution between 0 and 400 m altitude (BALTAG et al., 2009). In the middle and upper basin of the Olt River, 64% of the registered couples were found between 500 and 1000 m altitude (KÓSA et al., 2002a). In Cluj County (2014), the majority of the nests (55.28%) were found at altitudes between 300-500 m (KÓSA, 2015). Across the Romanian territory (2004), the majority of the couples (61.66%) brood below 200 m altitude and only 4.7% higher than 600 m (KÓSA, 2005, 2013).

The average altitude of the nests was 308.4 m (min. 131 m – Bârla, max. 664 m - Dragoslavele), (Table 3). It was used the GPS measurement, that differs by the Google Earth one (cf. Google Earth Database). On the unit of relief, it varied between 450 m (in the Topolog basin) and 184.93 m (in the Vedea Basin), respectively between 209.11 m (in the plain area) and 664 m (in the mountain area). In Moldova (2007), the highest altitude above sea level was 947 m, while the lowest one was 8 m (BALTAG et al., 2009) and at the national level, in 2004, the highest one was over 900 m (KÓSA, 2005). In the Caucasus, the nests are met up to 3000 m (LOVÁSZI, 2012). The mean altitude of all localities with stork nests in Romania was 248.4 m (KÓSA, 2013). In Cluj County (2014), it was 409.6 m (KÓSA, 2015).

With reference to the sea level altitude of the first nests (from the upstream to the downstream of the rivers that spring from the mountains zone), the mean is 549.28 m (n=7 rivers: the Topolog, the Argeş, the Vâlsan, the Râul Doamnei, the Bratia, the Bughea and the Dâmboviţa, the minimum = 372 m at Mălureni, on the Vâlsan River, the maximum = 664 m at Dragoslavele, on the Dâmboviţa River).

The number of unoccupied nests (uH) represents 10.81% of all nests (H), the number of nests with couples (HPa) represents 89.18% of all nests, the number of pairs not bearing chicks (HPo) represents 16.66% of all pairs (above the value of the national level – 5.01%; KÓSA, 2013), the number of pairs bearing chicks (HPm) represents 83.33% of all pairs (HPa). In Moldova, uH represents 3.93% (BALTAG et al., 2009).

172 chicks were counted in total (Table 1). Among the localities with nests, 3 (Dragoslavele, Bradu and Miroşi, 7.5%) did not have chicks, 36 (90.0%) had between 1 and 9 chicks and 1 (2.5%, Căteasca) had between 10 and 19 chicks (more exactly 17). Among the pairs with chicks (HPm), 4 (7.27%, at Mihăeşti – in Argeş Piedmont, and Bârla, Slobozia, and Ştefan cel Mare – in the Romanian Plain) had 5 chicks (Fig. 4).

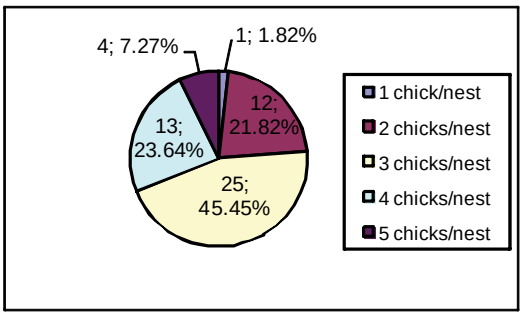

Figure 4. The nests distribution (%) by the number of chicks/nest (n=74).

In the middle and upper part of the Olt basin, the percentages were: 1.96% – 1 chick, 15.19% – 2 chicks, 37.25% – 3 chicks, 36.52% – 4 chicks, 8.57% – 5 chicks. 2 nests had each 6 fledglings (KÓSA et al., 2002a). In Cluj County, 2014, 4 young storks (38.37%) were the most common (KÓSA, 2015). In Romania: HPm1 – 3.52%, HPm2 – 28.57%, HPm3 – 37.31%, HPm4 – 26.59%, HPm5 – 3.88%; five nests had 6 young storks each. In Argeş, 19 nests (25.67%) did not host chicks, 13 nests (17.56%) hosted between 1 or 2 chicks, 38 nests (51.35%) hosted 3 or 4 chicks and 4 nests (5.40%) hosted 5 or 6 chicks.

We observe that JZa (the mean of chicks/pair), respectively JZm (the mean of chicks/pair with chicks), were the highest (5) in one locality – Slobozia (2.5% of all localities), where a couple with

5 chicks was observed. In 8 localities (20.00%, Corbi, Costeşti, Mălureni, Mihăeşti, Recea, Schitu Goleşti, Ştefan cel Mare and Vlădeşti), JZa, respectively JZm, were 4. At the other extreme, JZa was 1 in one locality (2.5%, Răteşti, where at 5 pairs, among them 3 without chicks, only 5 young storks were recorded) and JZm was 1.5 (2.5%, Pietroşani, where 3 young storks were recorded at 2 pairs). These facts highlight that the white storks breed successfully anywhere they find sufficient resources of food and places of nests, from the depressions of the submountain regions to the plains. The situations from Răteşti and Pietroşani could be determined by the unfavourable weather conditions or other unknown factors that intervened during the eggs incubation and upbringing of chicks. In the mountain region, a conclusion cannot be drawn. In the submountain region, JZa and JZm were equal (2.83), which suggests a good state of the population. In the Getic Piedmont, there were the biggest values (3.14, respectively 3.38), in other words the population of white storks increases here. They had the best conditions for growing chicks, where they nested. In the Romanian Plain, also there is a stable population (2.41, 3.13), but we observe an important number of pairs without chicks (23.07%). Regarding the hydrographical basins, the population is stable in each of them. The one from the Neajlov basin is at the inferior limit of JZa (2.15) and the one from the Topolog Basin at the inferior limit of JZm (2.5). The populations from the Vedea basin and from the Argeş basin (including tributaries) are well situated. The population from the Râul Doamnei basin (with tributaries) deserves a special attention, because it has the biggest values of all analysed basins (3.0, respectively 3.18). At the general level, JZa was 2.60 and JZm was 3.12, which means that the population is more than constant (minimal values considered to be necessary are 2, respectively 2.5). For the first nests from upstream to downstream of the rivers that spring from the mountain region we have JZa=2.5 and JZm=3 (Table 2). In Moldova, JZa was 2.25 and JZm, 2.73 (BALTAG et al., 2009), in the middle and upper part of the Olt basin, JZa and JZm were 2.88 and 3.33 (KÓSA et al., 2002a), in Cluj County, 2014, JZa was 3.12 and JZm was 3.38 (KÓSA, 2015), and at the national level, JZa was 2.72 and JZm was 2.99 (KÓSA, 2005).

StD is 0.96 HPa/100 km^2 for the entire territory of Argeş County (Table 1). It varies between 0.83 HPa/100 km^2 at Dragoslavele and 8.54 HPa/100 km^2 at Câmpulung (the areas of the localities, by https://cjarges.ro and http://www.ghidulprimariilor.ro). At Buzoeşti, the largest locality among the localities with nests, it was 2.49 HPa/100 km^2 and at Căteasca, the locality with the biggest number of nests and chicks, it was 7.36 HPa/100 km^2. Regarding the built-up area only (by http://www.ghidulprimariilor.ro), it fluctuated between 5.35 HPa/100 km^2 at Mălureni and 106.95 HPa/100 km^2 at Pietroşani. Per total localities with nests, StD is 2.72 HPa/100 km^2 and StD in the built-up area is 21.95 HPa/100 km^2. In the mountain area, StD is 0.06 HPa/100 km^2, in the hilly area (Submountain region and Getic Piedmont) StD is 0.69 HPa/100 km^2, and in the plain area StD is 2.85 HPa/100 km^2. Regarding the hydrographical basins, we have only the Râul Doamnei Basin where StD is 0.93 HPa/100 km^2 (that is comparable to the one of the county level), but, if the mountain area is not taken into consideration (nearly 30% of the drainage surface), StD is approximately 1.33 HPa/100 km^2. These indicate that the most advantageous area for breeding is the plain. Other densities obtained in our country: 0.89 HPa/100 km^2 in Moldova (maximum 4.36 HPa/100 km^2 in the Suceava River basin and minimum 0.72 HPa/100 km^2 in the Siret River basin), (BALTAG et al., 2009), 5.46 HPa/100 km^2 in the middle and upper basin of the Olt River (KÓSA et al., 2002a), 1.39 HPa/100 km^2 in Cluj County, in 2014 (KÓSA, 2015) and 4.17 HPa /100 km^2 at the national level (KÓSA, 2005). Generally, the densities we calculated were below the national level one, except those at small scale from some localities, where in the built-up area they exceeded 100 HPa/100 km^2. Densities that reach 50 HPa/100 km^2 were calculated locally in our country, too (KÓSA, 2013).

The nests were placed especially on the low voltage electric poles (Table 1, Fig. 5). In other areas: 92.92% – electric poles, 1.97% – trees and 1.97% – chimneys, in Moldova (2007), 89.10% – electric poles, 6.04% – trees and 1.75% – chimneys, in Moldova (2004, 2006 and 2007, BALTAG et al., 2009), 91.86% – electric poles, 1.62% – trees and 6.5% – buildings, in Cluj County, 2014 (KÓSA, 2015), 83.9% – electric poles, 3.49% – trees and 12.2% – buildings, in Romania, 2004 (KÓSA, 2013). In SE Europe, in 1994, 50-70% of the nests were built on electric pylons; locally, this rate reached 95-97% (LOVÁSZI, 2012). These show the adaptability of the birds to the new conditions of life. The situation is similar if we take in account the main relief units from the area, the hydrographical basins, the altitude above sea levels or the first nests (from upstream to downstream of the rivers that spring from the mountain zone). A mention has the Râul Doamnei (with tributaries) basin, where 61.90% of the nests were installed on simple electric poles, and 38.10% on electric poles with support; 8 nests were in this situation, here starting the process of supports montage (Table 2, Fig. 5).

All the nests installed on trees were built on ashes (*Fraxinus excelsior*) from the plain, even if there are many artificial adequate places in the area; so, there are just a few birds that prefer their breeding ancestral conditions. Though there is only a case of nesting on chimney, it represents the nest from the highest elevation (at nearly 15 m, on a building from Corbeni). The minimum height of the nest place (5 m) was recorded in a tree at Şerboeni. The mean of the heights for Argeş County where the nests were installed is 8.66 m (Table 4).

It is remarkable the inclination of the storks for the precompressed vibrated poles as regard the nests places (66 nests, 97.05% of all). Only 2 nests were installed on concrete round pole (1.48%) and these reflects the higher frequency of the precompressed vibrated poles (Fig. 6). Concerning the thickness, 59 nests (86.76%) were installed on thick poles and 9 nests (13.24%), on narrow poles, in relation with the better stability for the nests, which the thicker poles offer by comparison with the narrow ones.

Table 2. The white stork breeding parameters by areas and sea level altitudes and the nests placement (n=74).

Parameter		Number of nests (H)	Number of nests (H) (%)	Pairs with chicks (HPm)	Pairs without chicks (HPo)	Number of pairs (HPa)	Solitary stork	Unoccupied nests (uH)	JZG	JZa	JZm	Nests on simple electric poles	Nests on electric poles with support for nest	Nests on chimneys	Nests on trees
Forms of relief	Mountain region	1	1.35	0	1	1	0	0	0	-	-	1	0	0	0
	Submountain region	15	20.27	12	0	12	0	3	34	2.83	2.83	9	5	1	0
	Getic Piedmont	16	21.62	13	1	14	0	2	44	3.14	3.38	12	4	0	0
	Romanian Plain	42	56.75	30	9	39	0	3	94	2.41	3.13	33	4	0	5
Hydrographic basin	Topolog	2	2.70	2	0	2	0	0	5	2.5	2.5	2	0	0	0
	Vedea	16	22.97	13	2	15	0	1	40	2.66	3.07	11	3	0	2
	Argeş with tributaries	56	75.67	40	9	49	0	7	127	2.59	3.17	42	10	1	3
	Neajlov	19	25.67	13	6	19	0	0	41	2.15	3.15	15	1	0	3
	Râul Doamnei with confluents	21	28.37	16	1	17	0	4	51	3	3.18	13	8	0	0
Altitude above sea level	100-199 m	15	20.27	12	2	14	0	1	40	2.85	3.33	12	2	0	1
	200-299 m	27	36.49	19	6	25	0	2	57	2.28	3	21	2	0	4
	300-399 m	12	16.22	9	2	11	0	1	29	2.63	3.22	11	1	0	0
	400-499 m	13	17.57	10	0	10	0	3	31	3.1	3.1	6	7	0	0
	500-599 m	4	5.41	4	0	4	0	0	13	3.25	3.25	3	1	0	0
	600-699 m	3	4.05	1	1	2	0	1	2	1	2	2	0	1	0
The first nests from upstream to downstream		7	9.45	5	1	6	0	1	15	2.5	3	5	1	1	0

Table 3. The average sea level altitude (m) of the nests from Argeş County (n=74).

Parameter	General	Topolog Basin	Vedea Basin	Argeş Basin	Râul Doamnei Basin	Neajlov Basin	Submountain Area	Getic Area	Plain Area	100-199 m	200-299 m	300-399 m	400-499 m	500-599 m	600-699 m	First nests from upstream to downstream
Mean	308.4	450	184.9	338.6	444.4	218	502.9	364.3	209.1	164.2	232.0	349.4	451.6	527.7	639.3	549.2
Standard Error	15.61	69	8.88	17.59	16.39	9.34	15.83	12.32	6.37	4.36	4.40	8.72	7.89	7.90	18.55	38.61
Minimum	131	381	131	150	329	150	426	254	131	131	200	306	402	513	603	372
Maximum	664	519	263	664	651	309	651	443	309	189	274	383	495	549	664	664
Confidence Level (95.0%)	31.12	876.72	18.94	35.26	34.20	19.62	33.96	26.27	12.87	9.36	9.04	19.19	17.19	25.17	79.81	94.48

Table 4. The average of the height (m) of the nest places (n=74).

Parameter	General	Submountain area	Piedmont	Plain	Topolog Basin	Vedea Basin	Argeş Basin	Neajlov Basin	Râul Doamnei Basin	100-199 m	200-299 m	300-399 m	400-499 m	500-599 m	600-699 m	First nests from upstream to downstream
Mean	8.66	9.45	8.66	8.38	7.5	8.21	8.83	8.47	9.26	8.11	8.54	8.35	9.44	8.12	11.33	9.39
Standard Error	0.18	0.57	0.34	0.20	0	0.42	0.20	0.25	0.35	0.08	0.30	0.28	0.50	0.62	1.92	1.00
Minimum	5	7.5	7.5	5	7.5	5	7.5	7.5	7.5	7.5	5	7.5	7.5	7.5	8.5	7.5
Maximum	15	15	11.8	13.5	7.5	13.5	15	11.44	13.5	8.62	13.5	10.8	13.5	10	15	15
Confidence Level (95.0%)	0.36	1.23	0.74	0.41	0	0.90	0.41	0.53	0.74	0.18	0.63	0.63	1.09	1.98	8.270	2.46

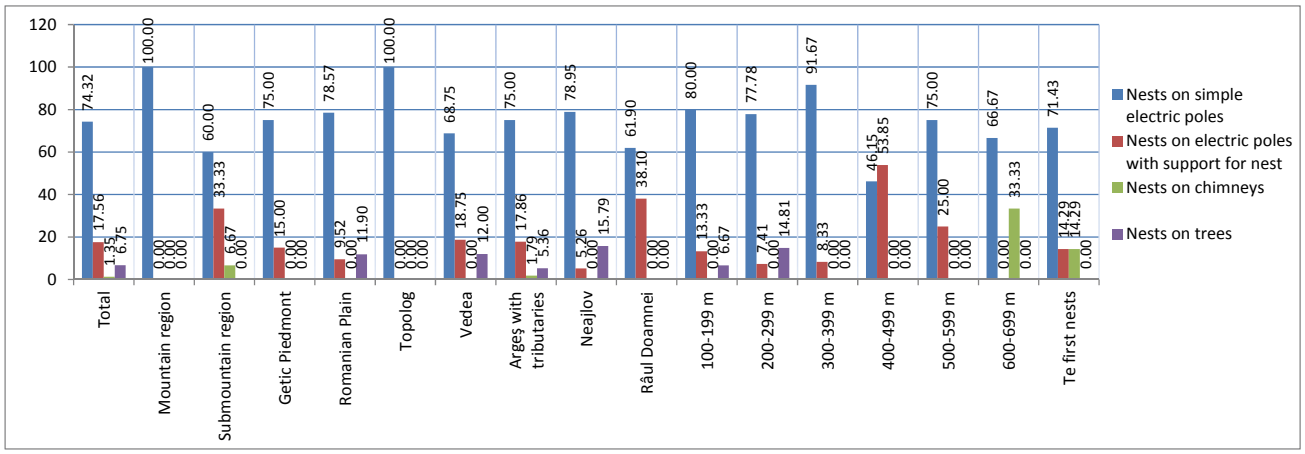

Figure 5. The placement of the nests (%) according to the units of relief (n=74).

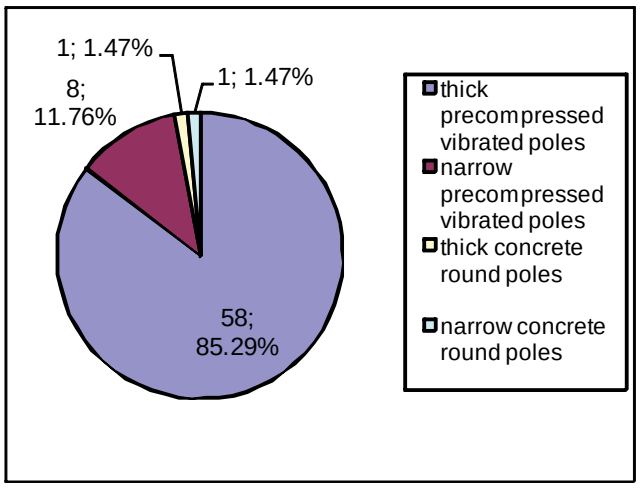

Figure 6. The distribution of the nests (%) by the type of electrical poles (n=74).

From the point of view of the position of the nests relative to human settlements, only 1 nest (1.35%, at Căldăraru, in the Romanian Plain) was built outside the localities (Fig. 7), whereas here there are sufficient favourable nest supports (electrical concrete poles along the roads or trees along the rivers). The better assurance against the predators in localities is the principal reason that explains this state of facts.

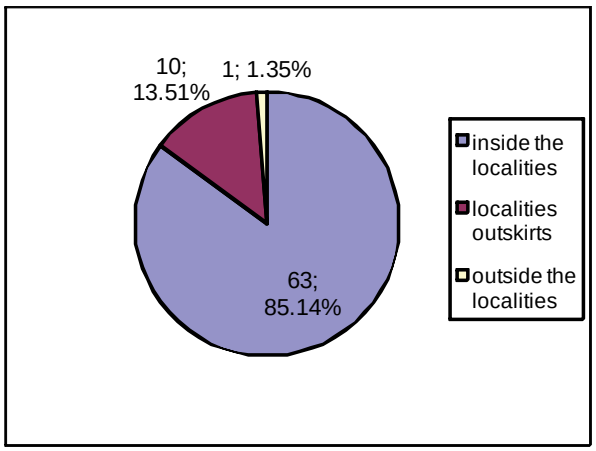

Figure 7. The distribution of the nests (%) by their location in rapport to the human settlements (n=74).

It is interesting that 68 nests (91.89%) were realised on supports located near the roads (mains or secondary roads), that because often the low voltage net marginalises these. Moreover it is outstanding that many nests were placed near the crossroads, good visual marks and generally large places, and the explanation that here there are thick poles is only partially valid, as they can also be found in other places (Fig. 8).

No locality can be considered colony (village with at least 5 breeding pairs no more than 1 km from their nearest neighbour, KÓSA, 2013). The distance between the nests varied between 461 m and 12,784 m, the mean being 3,458.91 m. The maximum was between the nest from Ciofrângeni and the one from Curtea de Argeș, but probably the nest from Ciofrângeni is closer to one from Vâlcea County. Thus, the biggest distance among the each nest and the nearest one seems to be between the nests from Dragoslavele and Câmpulung (11,780 m). In Cluj County, the average was bigger – 4,320.54 m, with maximum of 25,399 m (KÓSA, 2015).

Wetlands are not necessary, but the white storks are more aquatic in the nesting area than in the wintering sites (LOVÁSZI, 2012). Because a good part of the food consists of aquatic and amphibious items, the discharge and the length of the rivers and the distance between the nests and the wetland feeding places can be important.

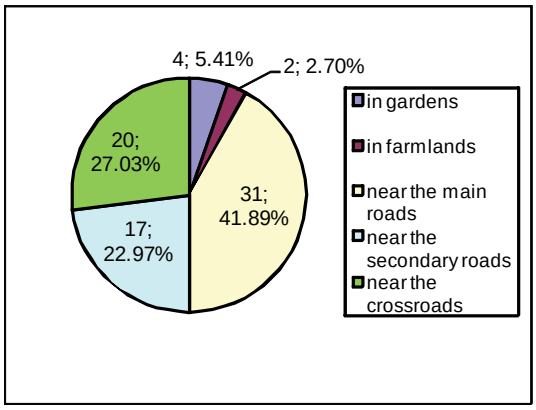

Figure 8. The distribution of the nests (%) by their location (n=74).

From the point of view of the average multi-annual discharge of the rivers from the vicinity (cf. www.rowater.ro), the first nests from upstream to downstream were placed in mean somewhere between 1.89 m^3/s (for the first 7 points of measurements from upstream) and 3.21 m^3/s (for the first 10 points of measurements from downstream). An exact situation cannot be sketched because of the insufficient hydrometric posts. There are not assays at the corresponding place of these nests and, also, we do not have measurements of the discharge for the other nests from Argeș County.

Regarding the length of the rivers up to the nest sites, the one for the rivers that spring from the mountain area is more significant: this varied between 8 km (at Campulung, on the Bughea River) and 68.2 km (at Mălureni, on the Vâlsan River), the mean being 41.95 km (n=7 rivers: the Topolog, the Argeș, the Vâlsan, the Râul Doamnei, the Bratia, the Bughea and the Dâmbovița).

In the same context, concerning the distance between the nests and the nearest wetland feeding place, the mean is 299.71 m (n=7 samples, the minimum = 372 m at Corbi, on the Râul Doamnei, the maximum = 664 m at Câmpulung – Grui District, on the Bughea, tributary to the Bratia River). On the general level, this mean was calculated at 393.01 m (Table 5), but it is known that the birds may hunt several km around their nests (LOVÁSI, 2012). The distances were measured in Google Earth and they are not very accurate.

Table 5. Distance (m) between nest and the nearest feeding place.

Parameter	Value	Observations
Mean	393.01	
Standard Deviation	24.92	
Minimum	63	At Căldăraru
Maximum	1028	At Coșești
Confidence Level (95.0%)	49.67	

The dynamics of the breeding

By comparison with the situation from Argeș County at the precedent census (MESTECĂNEANU et al., 2012), that was performed in 2004 (a little warmer and rainier year than normal in Romania for 1961-1990: 9.4°C – the average air temperature, +0.6°C, and ca. 680 mm – the annual precipitation, +38 mm, cf. Sandu, 2005), we remark: 1) **an increase of 1.96% of the localities where there were identified the white stork nests,** where the number of cities increased from 1 to 4; 2) an increase of 7.5% of the localities with 1 nest, a decrease of 6.71% of the localities with 2 nests, a decrease of 8.02% of the localities with 3 nests, an increase of 5.00% of the localities with 4 nests, a decrease of 0.13% of the localities with 5 nests, an increase by 2.5% of the localities with 6 nests, an increase by 2.5% of the localities with 7 nests, and a decrease by 2.63% of the localities (Bârla) with 9 nests; 3) a decrease of 4.76% (from 21 to 20) of the localities with stork nests from the hilly area and an increase of 18.75% (from 16 to 19) of the localities with stork nests from the plain area; 4) **an increase of 4.05% of the total number of nests**; 5) a more accurate evaluation of the number of pairs (maximum 70-90, that mains 1.45% of the Romanian population); 6) a decrease by 1.52% of the nests from the Topolog basin, a decrease by 0.97% of the nests from the Vedea basin and an increase by 3.84% of the nests from the Argeș basin; 7) an increase by 2.36% of the number of unoccupied nests, a decrease by 2.36% of the number of nests with couple, an increase by 13.85% of the number of pairs not bearing chicks, and a decrease by 5.4% of the number of pairs bearing chicks; 8) **an increase by 19.18% of the total number of chicks**; 9) the highest JZa, respectively JZm, increased from 3 to 5; 10) the lowest values of JZa, respectively JZm, remained constant (1, respectively 1.5); 11) **an increase of JZa (from 2.13 to 2.60) and JZm (from 2.20 to 3.12%) at the general level**; 12) **a small increase of 0.01 HPa/100 km^2 for the entire territory of Argeș County**; 13) an increase by 1.34% of the pairs with 1 chick, a decrease by 51.19% of the pairs with 2 chicks, an increase by 21.65% of the pairs with 3 chicks, an increase by 23.64% of the pairs with 4 chicks, and an increase by 7.27% of the pairs with 5 chicks; 14) a decrease by

6.78 m of the average altitude of the nests, but this can be the effect of different types of measurements (GPS versus Google Earth); 15) a decrease by 2.26% of the number of nests located between 100 and 199 m, an increase of 11.14% of the number of nests located between 200 and 299 m, a decrease by 9.13% of the number of nests located between 300 and 399 m, a decrease by 3.55% of the number of nests located between 400 and 499 m, an increase of 4.01% of the number of nests located between 500 and 599 m, and a decrease by 0.17% of the number of nests located between 600 and 699 m; 16) **an increase of 21.47% of the nests placed on the low voltage electric poles, a decrease by 21.41% of the nests placed on the trees**, and a decrease by 0.05% of the nests placed on the chimneys, fact that shows the adaptability of the birds to the new breeding circumstances.

Though the number of chicks increased by comparison with 2004, despite the fact that 2014 was warmer (+1.4°C, 15.90% – annual air temperature increase) and rainier (+165.8 mm, 26.63% – annual precipitation increase; 39.61% – precipitation increase in April-July) than usual (1961-1990), it does not indicate for sure good conditions for the storks, because even if these involve an increase of the food supply, also they can led to the egg chilling and to the increase of the chicks mortality, mainly in the first days after hatching.

CONCLUSIONS

Comparing the actual results to the ones from 2004 census, some conclusions can be done:

- The white storks avoided the breeding areas where there did not exist concomitantly some fundamental factors; among them, the human settlements, mainly the rural ones, and the food resources are the most important, because into the human settlements the birds have protection against predators and benefit from the friendly people attitude;
- The incorrect agricultural practices and the quality of the waters can limit the distribution in the breeding season; other factors like the collisions with the electrical wires/the wind turbines are minimal/inexistent;
- The plain and the hilly area, dominated by large valleys with villages and crops, are the most favourable for the birds breeding, fact that is obvious from the sea level altitude of the nests, the JZa, JZm, StD, etc., too;
- The storks adapted very well to live near the humans: the nests are placed chiefly on the non-natural supports and the disposition of the nests is predominantly into localities; this results, also, from the obvious increase in ten years of the nests installed on the low voltage electric poles that is almost equal to the decrease of the nests installed on the trees;
- The population of the white storks from Argeş County shows a slight increase, that is visible in the number of the localities occupied by them, in the whole number of nests, in the total number of chicks, in JZa, JZm, and StD at the county level; this reflects the positive trend of the species at national and European level but, also, can be the effect of the climate from the respective years;

We consider that the actions of protection of the species begin to demonstrate encouraging consequences. The insulating of the electrical installations against electric shock and the sustaining of the nests with artificial supports must continue, in tandem with the improving of the agricultural politics and the increasing of the water quality. Also, we think that, for the moment, the development of the colonies through the placement of artificial nesting supports on the electric poles is inopportune, if the birds did not have sufficient food resource, and, at this moment, the transferring of the old and any new nests on artificial supports is a better solution. Also, the educational measures have to be better taken into account. Despite of these, the protection in the breeding areas is without great successes for the storks if there is not protection in the passage and winter quarters.

The monitoring must continue to observe the adaptability of the birds to the future anthropogenic conditions and to adopt the necessary measures if the population decreases again.

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