

DISTRIBUTION, POPULATION SIZE AND DYNAMICS OF THE WHITE STORK (*CICONIA CICONIA* L.) IN THE UPPER AND MIDDLE OLT RIVER BASIN (ROMANIA)

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Abstract

Based on the results of the censuses carried out between 1996-2000, the total population of the Upper and Middle Olt River Basin is 721 HPa distributed in 304 localities. The total population of the region can be estimated to approx. 800 HPa. About 30% of Transylvanian population and about 16% of Romanian population breeds in the study area. From a vulnerability, conservational and monitoring point of view it is important to note that ~10% of the localities hold almost half (328 HPa - 45.49%) of the total breeding population of the whole area. The mean population density (StD) for the whole area was 5.469 HPa/100 km². Out of a total of 721 breeding pairs, 64% were found to nest at altitudes between 500-1000 m and only 36% nests within the altitudinal belt of 300-500 m. Most common nest sites are electric pylons (45.26%), barns (24.47%) and chimneys (22.48%). Since the 1960-s massive changes have been observed in nest site preferences, from buildings to electric pylons. The mean JZa and JZm values for the Upper and Middle Olt River Basin were above 2.0 and 2.5 in 1998-2000, values which are higher than the estimated JZa and JZm values needed to keep the population stable. The White Stork population of the Middle and Upper Olt River Basin has undergone a continuous decrease from the sixties until the end of the nineties. Positive populational changes can be seen, with the exception of the Făgăraş Basin, only in the 1988/1989-2000 period: the population has recovered to the level of the sixties and is still increasing in the Ciuc, Târgu Secuiesc and Sibiu Basins.

Keywords: White Stork, Olt River Basin, distribution, population size, breeding success, colonial nesting, nest site selection, population trends.

Introduction

The White Stork has been identified as a priority bird species in 4 out of 7 agricultural and grassland habitats of Europe (Tucker and Dixon 1997), and recently it was proposed as a habitat indicator species for agricultural habitats by Tucker *et al.* (2000). The White Stork is a flagship species for the international conservation of wetlands, ecologically valuable river lowlands and low intensity farmland as well as for the conservation of migratory birds in general (Samusenko 2000). Thus conserving the White Stork is an important contribution toward the preservation of biodiversity and consequently to the implementation of the Convention on Biological Diversity (Schulz 1999b).

The White Stork is distributed over the entire territory of Romania and the total number of breeding pairs was estimated by the last national census (1999) to ~ 4500 breeding pairs (Kósa 2001). The first regional White Stork census in this area was conducted between 1909-1915 by Jakab Schenk (Salmen 1980), but more detailed censuses were made only in the second half of the 20th century. Data on the numbers and population trends of the White Stork in the the Middle and Upper Olt River Basin were published by the following authors: Béldi (1962), Damó (1984, 1985, 1994), Demeter (2001a, 2001b), Klemm (1969, 1975a, 1975b, 1983), Klemm and Salmen (1988), Kohl (1980), Kovács (1975, 1976), Kováts (1968a, 1968b, 1974), Molnár (1979, 1981, 1990), Lutsch (1990), Lutsch, Philippi and Popa (1990), Philippi (1997), Philippi (2001), Philippi and Popa (1990b), Popa (1983), Szabó and Papp (1996), Weber and Antal (1978).

The main goal of this study was to locate and characterize the nest sites used by White Storks in the Upper and Middle Olt River Basin. The second aim was to evaluate all the population data essential for the analysis of the White Stork population in the Upper and Middle Olt River Basin to forecast its further population trends (in addition, in the future our databases will make possible further comparative analysis of the different population parameters in this area). The third aim was to elaborate recommendations for the protection of the White Stork populations and stork habitats. Partial results of our study were published by Demeter (2001a, 2001b) and Philippi (2001).

Material and Methods

Our study was carried out mainly from 1 July to 10 August 2000 when ~80% out of our data were collected in the Upper and Middle Olt River Basin. The other ~20% of the data were counted by the authors between 1996-1999.

The Upper and Middle Olt River Basin occupies the middle part of Romania (the south-eastern corner of Transylvania) and is situated within four counties (Harghita, Covasna, Brasov, Sibiu) along 386 river kilometers. The total size of the Upper and Middle Olt River Basin is 13181 km² (Ujvári 1972). The geographical range of the area is from 23°40'E to 26°24'E and from 45°24'N to 46°45'N. The Upper and Middle Olt River Basin consists mainly of intramountainous basins surrounded by 1500-2500

m high mountains in the NW, N, E, S and SW parts. Forests cover 35-45% of the territory, the potential White Stork habitats (arable land + pastures + meadows) amount to 50-61% .

The studied territory was subdivided into seven regions (Fig. 1):

1. Ciuc Basin: includes the catchment area of the Olt between the spring and Micfalău;

2. Târgu Secuiesc Basin: includes the catchment area of the Negru River (without the drainage area of the tributary Târlung River), the Casinu Basin and the drainage area of the Olt River between Micfalău and confluence point with the Negru River;

3. Bârsei Basin: also includes the Baraolt Basin;

4. Homoroade Rivers Basin: the hydrological drainage area of the Homoroade rivers;

5. Făgăraș Basin: includes the Olt catchment area between Racoș and the confluence point with the Lotrioara River, without the Homoroade and the Cibin River Basins;

6. Hârtibaciu River Basin: the hydrological drainage area of the Hârtibaciu River;

7. Sibiu Basin: the hydrological drainage area of the Cibin River, without the drainage area of the Hârtibaciu River.

White Stork population parameters were recorded according to the international abbreviations (Schulz 1999a):

HPa – number of pairs occupying a nest, nesting pairs ($HPa = HPm + HPo + HPx$);

HPm – number of pairs with fledglings;

HPo – number of pairs occupying a nest but without fledgling;

HPx – number of pairs with unknown breeding success;

JZG – total number of fledglings in a defined area per year;

JZa – breeding success, average number of fledged young per pair related to all HPa of a defined area (JZG/HPa);

JZm – breeding success, average number of fledged young per pair related to all HPm of a defined area (JZG/HPm);

Std – “Stork density”: number of pairs (HPa) per 100 sq km of a defined area.

Data analysis was made with the FileMaker Pro software and the distribution maps were produced with the DMAP software.

Results and discussion

Distribution, population size and density

The White Stork breeds all over the study area with the exception of high mountainous regions and forested areas. Distribution of breeding pairs (HPa) is presented in Fig. 2. The species was identified in 304 localities (Table 5.). The distribution of the White Stork throughout the area is uneven. It reaches the highest

densities in the Ciuc and Târgu Secuiesc Basins, where grasslands are more widespread as compared to other regions.

Based on the results of the censuses carried out between 1996-2000, the total population of the Upper and Middle Olt River Basin is 721 HPa (Table 1. and Table 5.). As about 15% of the region was not covered by the censuses (mainly the small settlements from the mountainous area), the total population is estimated to approx. 800 breeding pairs.

About 30% of Transylvanian population and about 16% of Romanian population breeds in the study area. The percentage of unsuccessful pairs (%HPo) was low in 2000, only 10.017%.

The mean population density (StD) for the whole area was 5.469 HPa/100 km² (Table 1.). It is higher than the average value for Romania (4.48 HPa/100 km² - Kósa 2001) and much higher than for the Someş River Basin (2.78 HPa/100 km² - Kósa, unpublished results).

Breeding pairs were found in 100 full 10-km UTM squares and in 3 partial 10-km squares (from a total of 139 full and 7 partial 10-km squares) (Fig. 3). The species distribution thus covers 70.54% of the total area covered by the 146 UTM squares.

While the territory is not a typical stork habitat (Kováts 1968a), White Stork being a lowland grassland bird, the local density of breeding pairs in some places reaches 50 pairs/100 km² (in the UTM square 35TMM12) (Fig. 3), which is close to the maximal densities in Europe, and one of the highest in Romania.

Although the highest pair densities can now be found in the Ciuc Basin, Kováts (1968a, 1968b) put forward a hypothesis on a relative recent colonization of the Ciuc Basin by White Storks, based on the memories of elderly local people: the first nests appeared as late as during the second half of the 19th century, and spread from South to North. This hypothesis is apparently supported by the breeding data from the Upper and Middle Olt River Basin, published in the ornithological journal *Aquila* for the period 1906-1910: from a total of 49 "stork villages" only one, Sâncraieni is mentioned from the Ciuc Basin.

Some ringing recoveries also support the hypothesis of Kováts. The White Stork HGB 1257 ringed by Jakab Schenk in 1909 in Hăghig (Bârsei Basin) was recovered after four years in Joseni (Gheorgheni Basin) at a distance of 113 km to the north from the ringing site (Salmen 1980, Cătuneanu 1999). Three White Storks ringed by R. Iacobi in Arini (Bârsei Basin) were recovered later in NE and NW (Cătuneanu 1999; unfortunately the exact details of ringing and recovery places and dates are missing). All these four recoveries suggest a northward movement of some White Storks from the Bârsei Basin.

A gradual decrease in breeding pair density (StD) was found from the Upper Olt River Basin (Ciuc and Târgu Secuiesc Basins StD=7.11-7.68) to the Middle Olt River Basin (StD=4.35-5.97) (Table 1.), probably in close connection with changes in habitat.

Vertical distribution

Out of a total of 721 breeding pairs, 64% were found to nest at altitudes between 500-1000 m and only 36% nests within the altitudinal belt of 300-500 m (Fig. 4). To the best of our knowledge this altitudinal distribution is unique for the Carpathian Basin and probably also for Europe.

Breeding success

The JZa and JZm values, which characterize the breeding success, were calculated only for the year 2000. In this year 579 HPa (500 HPm + 21 HPx + 58 HPo) and 1669 JZG were recorded distributed in 206 localities. The mean JZa and JZm values for the Upper and Middle Olt River Basin were 2.883 and 3.338. The JZa and JZm values needed to keep the population stable are estimated to 2.0 (Burnhauser 1983) and 2.5 (Lakeberg 1995). As it can be seen in Table 1., the JZa values exceed 2.0 and the JZm values 2.5 in every studied region in 2000. Because high JZa and JZm values were registered also in the 1998-1999 period (Demeter 2001a, Kósa 2001 and other not published data), the White Stork population from the Upper and Middle Olt River Basin can be considered as a stable one.

The frequency distribution of brood size in 2000 for the study area was the following (Fig. 5): the percentage of nests with 1 young (HPm1) was 1.96%, HPm2 - 15.19%, HPm3 - 37.25%, HPm4 - 36.52%, HPm5 - 8.57%. Extremely high number of fledglings (6) was recorded for two nests.

Aggregability and colonial nesting

We used the following definition for White Stork colonies: villages with minimum 5 breeding pairs (Guziak and Jakubiec 1996) among which the maximal distance does not exceed 1 km (Chozas *et al.* 1989). White Stork colonies were identified in 31 localities of the Upper and Middle Olt River Basin (Fig. 2. and Table 5.). From a vulnerability, conservational and monitoring point of view it is important to note that ~10% of the localities hold almost half (328 HPa - 45.49%) of the total breeding population of the whole area!

In order to compare quantitatively the aggregability of White Storks in different regions we introduced two parameters:

I – *intensity* of colonial breeding (proportion of breeding pairs nesting in colonies);

F – *frequency* of colonial breeding (proportion of localities with colonies).

As Fig. 6 shows, the intensity (I) and frequency (F) of colonial breeding is the highest in the Ciuc, Sibiu and Târgu Secuiesc Basins. The highest aggregability levels (I > 55% and F > 15%) thus occur in the regions characterized also with the highest StD values (Table 1.).

JZa and JZm values calculated for the White Stork colonies (JZa=2.899 and JZm=3.302, n=328 HPa) were almost identical with the values for those localities where only 1-4 HPa breeds (JZa=2.861 and JZm=3.387, n=252 HPa). This is in

contrast with the findings of Radkiewicz (1989) who noted greater JZa and JZm values for White Storks colonies compared to solitary nests in West Poland.

The largest stork colonies can be found in the localities Cristian (30 HPa) and Sânsimion (27 HPa).

Nest site selection

The most common nest sites in the Upper and Middle Olt River Basin are electric pylons (45.26%), barns (24.47%) and chimneys (22.48%) (Table 2.). The frequency distribution of nest sites for Romania is the following: 69.31% of nests are constructed on electric pylons and 27.40% on buildings (chimneys + barns + roofs) (Kósa 2001). Thus the study area remains behind other regions in Romania as far as the proportion of nests constructed on electric pylons is concerned.

As Table 2. shows, there are regional differences in nest site preferences. The proportion of nests constructed on barns is the highest in the Ciuc and Târgu Secuiesc Basins (34.85-36.69%) and chimneys are preferred as nesting sites in the Bârsei and Sibiu Basins (43.97-54.16%) (Table 2.).

During the last decades massive changes have been observed in nest site preferences, from buildings to electricity pylons. This process differed significantly in various parts of the study area.

44 years ago White Storks in the Târgu Secuiesc Basin placed their nests exclusively on buildings and trees (Béldi 1962). In 1962-1963 Kováts found no nests constructed on electric poles in the Ciuc and Târgu Secuiesc Basins (Kováts 1968a, 1968b). Weber and Antal observed in Ciuc Basin in 1973 only nests constructed on buildings and in trees (Weber and Antal 1978). The first White Stork nests placed on electric poles were recorded in the late 1960-es by Dénes Emese in the Târgu Secuiesc Basin (Lemnia). In this region their proportion rapidly increased: from 3.2% in 1978 (Molnár 1979) to 15.6% in 1988 (Molnár 1990) and to 54.28% in 2000.

The situation is different in the Bârsei Basin. In 2000 the proportion of nests constructed on electric poles was still the lowest in the entire region (24.11%). The proportion of nests constructed on electric poles remained below 50% in the Făgăraş and Sibiu Basins and in the Hârtibaci River Basin, too.

The largest proportion of nests constructed on electric pylons can be found in the north and north-west of the area (Ciuc Basin, Homoroade Rivers Basin). The reason for this is most probably that nests built on electric poles spread from north (Gheorgheni Basin) and north-west (Mureş County) to the Ciuc and Homoroade Rivers Basins.

The proportion of nests placed on poles increased in parallel with the decrease of nests placed on buildings (see for example Molnár 1979, 1981). As suitable nesting places on chimneys and barns are becoming less abundant, electric poles probably serve as a substitute.

In the middle of the 1990s, in cooperation with the national electricity company, the installation of artificial nest platforms on electricity poles was begun in Harghita and Covasna counties (Upper Olt River Basin) and until 2000 about 86 poles were equipped with such platforms. No platforms were installed in Braşov and Sibiu

counties (Middle Olt River Basin). Consequently, there are still 234 nests in direct contact with electric wires.

Population trends

The Upper and Middle Olt River Basin, considering the available amount of White Stork population data, is one of the most studied areas in Romania. Despite this fact, the summarised data of the former censuses conducted between 1958-2000 cannot be directly compared for studies on population dynamics. Difficulties arise from the fact that during the censuses the sample areas were different and also when they were the same, in different years different localities were included in the monitoring.

To be able to compare the population trends between different regions in a given time period, we divided the whole time interval, based on the available census data, into the following periods: 1962/1963-1973/1974, 1973/1974-1988/1989 and 1988/1989-2000. Only those localities were included in the analyses where census data are available in two consecutive occasions. Despite the problems mentioned above, data obtained in this way provide a reliable basis to estimate simultaneously the long term population changes for the White Stork in the different regions of the Upper and Middle Olt River for a given time period (Table 3.).

The data presented in Table 3. show regional differences in population trends.

Although both in the Upper and Middle Olt River Basins the White Stork population decreased from the sixties to the seventies, this was more pronounced in the Sibiu and Făgăraş Basins (~ -28.3 - -43.82%) than in the Ciuc Basin (~ -10%). Among the causes of the decline Klemm (1983) listed the disappearance of wetlands due to drainage and river regulation following a systematic government plan and structural changes of the human settlements and attitudes with transition to urban building and behaviour.

In the 1973/1974-1988/1989 period the decline of Stork populations continues in all the regions from where census data are available. A clear difference can be seen in population decrease rate between the Upper and Middle Olt River Basins: the values are situated between -1.6 - -14.6% in the Upper Olt River Basin, and between -15.38 - -41% in the Middle Olt River Basin. The Olt River was drastically regulated in the Ciuc Basin in the late 1970-s, early 1980-s. As a result, the water table dropped and floods occur only rarely. The effect on the flora and fauna was dramatic, several species disappeared from the area. Unfortunately White Stork breeding data are lacking between 1973 and 1997 so we do not know in what manner was affected the breeding population in the first years after the river regulation. The Negru River (Târgu Secuiesc Basin) was regulated in 1974 and Kováts (1975) noted a marked drop in the number of breeding pairs in the localities situated along the river.

Positive population changes occurred only in the 1988/1989-2000 period; the populations recovered to the level of the sixties and are still increasing in the Ciuc, Târgu Secuiesc and Sibiu Basins. The present positive population trend of the White Stork in Eastern Europe is generally attributed to the crisis in agriculture during the economic transition period, which resulted in a rapid recovery of biological diversity on agricultural landscapes in these countries (Schulz 1999b). Although this statement

seems to be true also for Romania, we cannot exclude the possibility that populational increases observed in some regions (e.g. Sibiu Basin) are resulted from the immigration of breeding pairs from the most affected areas (e.g. Făgăraș Basin).

No HPa changes, compared to 1988/1989, took places in the Bârsei Basin.

The only region in the Middle and Upper Olt River Basin where the population decrease continues is the Făgăraș Basin (-20.1%). The Olt River valley from this region was classified as D-degraded in 1994 and remains one of the most polluted and degraded river sectors in the Upper and Middle Olt River Basin.

The breeding White Stork population in the lower sector of the Făgăraș Basin was negatively influenced probably also by the presence of some large dam-hydroelectric power station systems (CHE Arpașu de Jos, CHE Scorei, CHE Avrig, CHE Racovița) built between 1970-1990. The population decrease of White Storks in this sector can be seen in Table 4.

Conclusions

Based on the results of the censuses carried out between 1996-2000, the total population of the Upper and Middle Olt River Basin is 721 HPa distributed in 304 localities. The total population of the region can be estimated to approx. 800 HPa. In only 31 localities breeds about half (328 HPa) of the total breeding population of the area.

The mean population density (StD) for the whole area was 5.469 HPa/100 km², that is higher than the average value for Romania (4.48 HPa/100 km²). Out of a total of 721 breeding pairs, 64% were found to nest at altitudes between 500-1000 m and only 36% nests within the altitudinal belt of 300-500 m.

Most common nest sites in the Upper and Middle Olt River Basin are electric pylons (45.26%), barns (24.47%) and chimneys (22.48%). Since the 1960-s massive changes have been observed in nest site preferences, from buildings to electric pylons. This process differed significantly in various parts of the study area.

The mean JZa and JZm values for the Upper and Middle Olt River Basin were above 2.0 and 2.5 in 1998-2000, values which are higher than the estimated JZa and JZm values needed to keep the population stable, thus the White Stork population from the Upper and Middle Olt River Basin can be considered as a stable one.

The White Stork population of the Middle and Upper Olt River Basin has undergone a continuous decrease from the sixties until the end of the nineties. Positive populational changes can be seen, with the exception of the Făgăraș Basin, only in the 1988/1989-2000 period: the population has recovered to the level of the sixties and is still increasing in the Ciuc, Târgu Secuiesc and Sibiu Basins.

From a conservational point of view it is necessary to continue the monitoring of the White Stork populations in key sites (localities with more than 5 HPa). As the foreseeable introduction of the EU agricultural policy in Romania will damage White Stork feeding habitats, increasing efforts are needed to protect these regions. The installation of nestplatforms on electric poles must be continued and extended also in the Middle Olt River Basin.

Figure 1. Regional distribution of localities with White Stork nests in 1996-2000 (in brackets the number of localities whith nests in a given region)

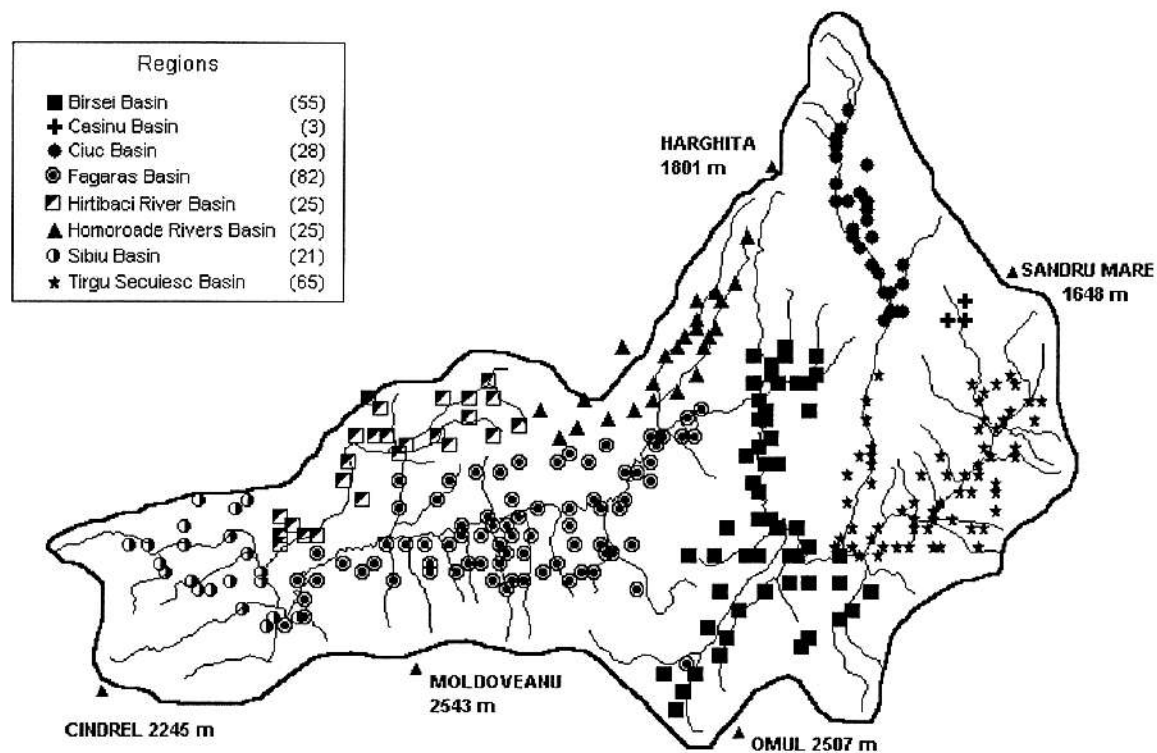
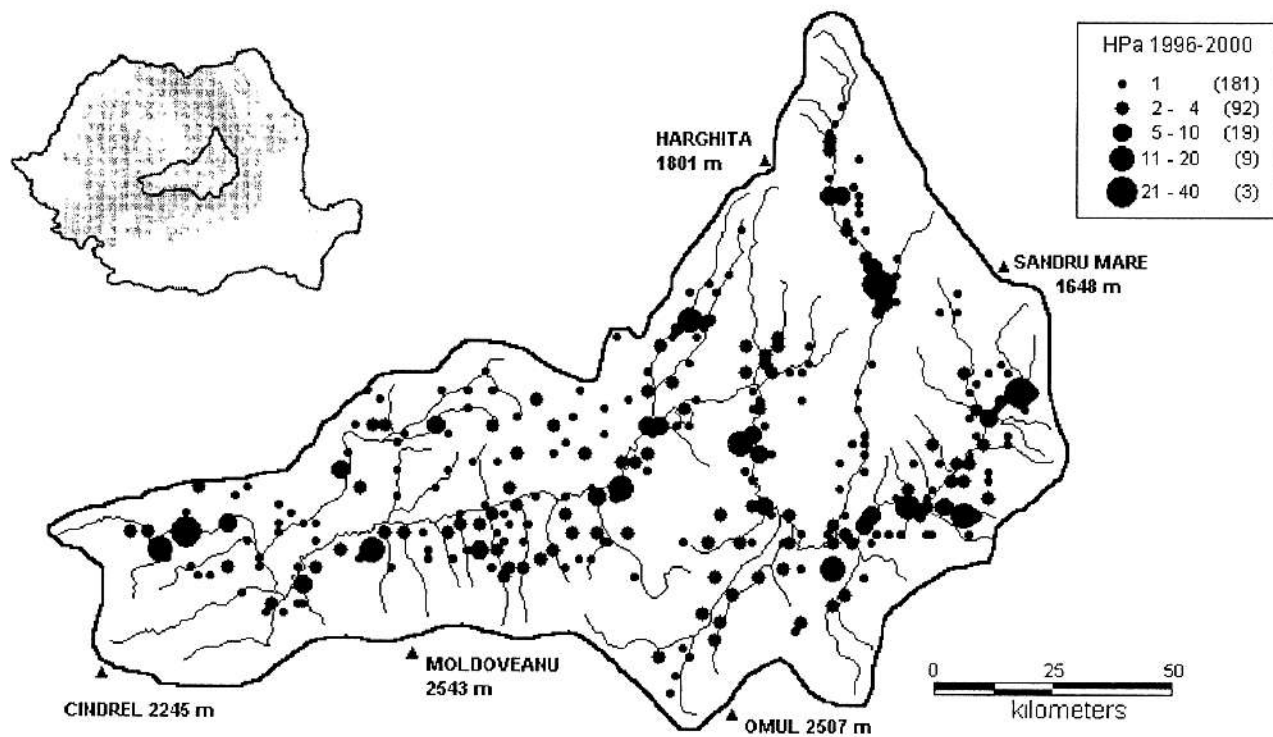


Figure 2. Distribution and number of White Stork breeding pairs (HPa) in the Upper and Middle Olt River Basin (1996-2000)
(Upper left corner: position of the study area in Romania; in brackets the number of localities corresponding to a given HPa range)



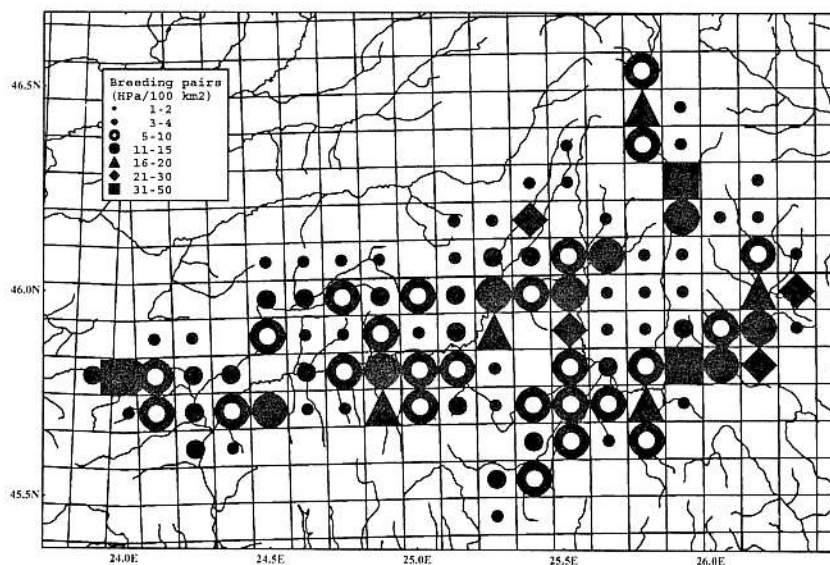


Figure 3. Distribution of White Stork pair densities (StD=HPa/100 km²) in the Upper and Middle Olt River Basin in 1996-2000 (UTM grid, 10x10 km quadrants)

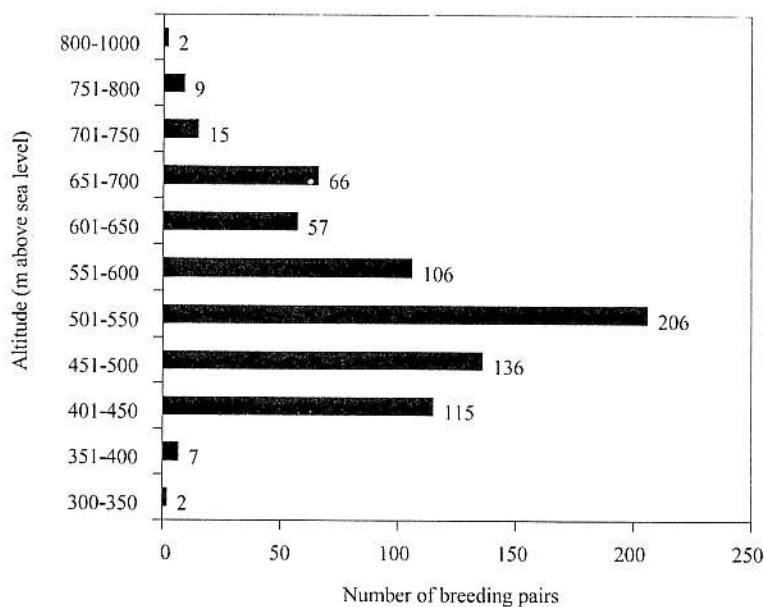


Fig. 4. Altitudinal distribution of nesting pairs (HPa) in the Upper and Middle Olt River Basin in 1996-2000 (n=721)

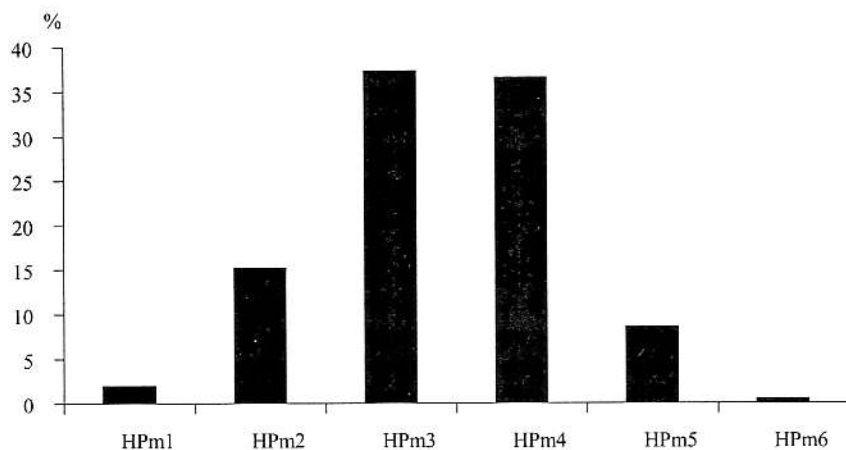


Fig. 5. The frequency distribution of brood size in the Upper and Middle Olt River Basin in 2000 (n=408 HPm)

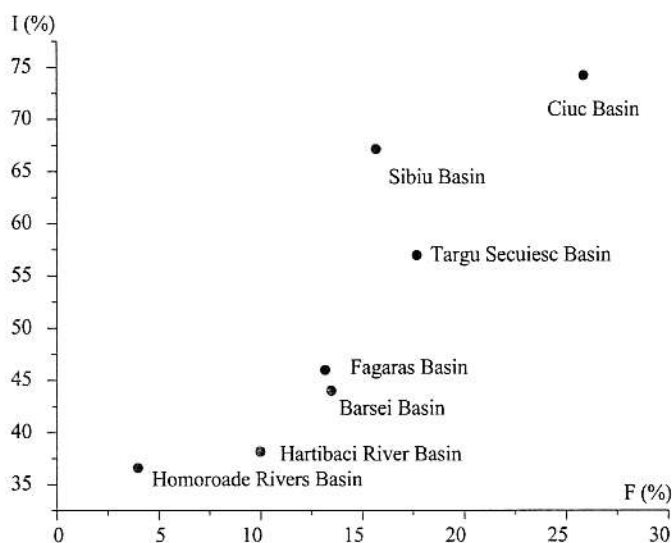


Fig. 6. Aggregability of breeding White Storks in the Upper and Middle Olt River Basin in 1996-2000 (F - frequency of colonial breeding; I - intensity of colonial breeding)

Table 1. Population and breeding parameters of the White Stork in the Upper and Middle Olt River Basin in 1996-2000

	Regions	Area (km ²)	Nr. of localities with stork nests	H	HPa	HPm	HPo	HPx	HE	uH	JZa*	JZm*	StD
Upper Olt River Basin	Ciuc Basin	1288	28	109	99	79	19	1	1	9	2.80	3.49	7.68
	Târgu Secuiesc Basin	2291	68	176	163	127	24	12	6	7	2.61	3.22	7.11
	Bârsei Basin	2760	55	148	133	121	8	4	4	11	2.97	3.27	4.81
Middle Olt River Basin	Homoroade Rivers Basin	837	25	52	50	42	6	2	0	2	2.76	3.34	5.97
	Făgăraș Basin	3768	82	175	164	143	13	8	2	9	3.01	3.40	4.35
	Hârtibaci River Basin	1031	25	40	40	39	1	0	0	0	3.63	3.73	3.87
	Sibiu Basin	1206	21	72	72	66	6	0	0	0	2.87	3.14	5.97
	TOTAL	13181	304	772	721	617	77	27	13	38	2.883	3.338	5.469

* JZa and JZm values were calculated only for 2000

Table 2. Distribution of different nest support types of White Stork nests in the Upper and Middle Olt River Basin

	Regions	Electric pylon (total)	Electric pylon without support	Electric pylon with support	Chimney	Roof	Barn	Tree	Other	Total
Upper Olt River Basin	Ciuc Basin	62 (56.88%)	22 (20.18%)	40 (36.69%)	4 (3.66%)	0	40 (36.69%)	3 (2.75%)	0	109
	Târgu Secuiesc Basin	95 (54.28%)	71 (40.57%)	24 (13.71%)	12 (6.85%)	3 (1.71%)	61 (34.85%)	4 (2.28%)	0	175
	Bârsei Basin	34 (24.11%)	29 (20.56%)	5 (3.54%)	62 (43.97%)	12 (8.51%)	26 (18.43%)	5 (3.54%)	2 (1.41%)	141
Middle Olt River Basin	Homoroade Rivers Basin	29 (64.44%)	12 (26.66%)	17 (37.77%)	7 (15.55%)	3 (6.66%)	3 (6.66%)	0	3 (6.66%)	45
	Făgăraș Basin	69 (41.81%)	69 (41.81%)	0	41 (24.84%)	5 (3.03%)	43 (26.06%)	6 (3.63%)	1 (0.6%)	165
	Hârtibaci River Basin	11 (45.83%)	11 (45.83%)	0	7 (29.16%)	5 (20.83%)	0	0	1 (4.16%)	24
	Sibiu Basin	20 (41.66%)	20 (41.66%)	0	26 (54.16%)	2 (4.16%)	0	0	0	48
	Total	320 (45.26%)	234 (33.09%)	(86) (12.16%)	159 (22.48%)	30 (4.24%)	173 (24.47%)	18 (2.54%)	7 (0.99%)	707

Table 3. Population trends of the White Stork in the Upper and Middle Olt River Basin between 1962-2000 (based on data published by Klemm (1975a, 1975b), Kovács (1976), Kovács (1968a, 1968b), Lutsch (1990), Lutsch, Philippi and Popa (1990), Molnár (1978, 1990), Philippi and Popa (1990), Weber and Antal (1978)) (n – number of compared localities)

	1962/63-1973/74	1973/74-1988/89	1988/89-2000
Ciuc Basin	- 9.75 % (1962: 82 HPa → 1973: 74 HPa; n=15)	+ 14.86 % (1973: 74 HPa → 2000: 85 HPa; n=15)	
Târgu Secuiesc Basin	- 26 % (1963: 92 HPa → 1974: 68 HPa; n=21)	- 1.6 % (1974: 123 HPa → 1988: 121 HPa; n=41)	+ 15.7 % (1988: 121 HPa → 2000: 140 HPa; n=41)
		+ 11.38 %	
Bârsei Basin	- 26.8 % (1963: 41 HPa → 1974: 30 HPa; n=13)	- 14.6 % (1974: 89 HPa → 1988/1989: 76 HPa; n=28)	0 % (1988/1989: 85 HPa → 2000: 85 HPa; n=32)
		- 17.98 % (1974: 89 HPa → 2000: 73 HPa; n=28)	
Homoroad Rivers Basin	-	-	+ 12.5 % (1989: HPa 8 → 2000: 9 HPa; n=7)
		- 9.09 % (1962: 22 HPa → 2000: 20 HPa; n=7)	
Hârtibaciul River Basin	-	- 41.17 % (1974: 34 HPa → 1989: 20 HPa; n=12)	+ 25 % (1989: 20 HPa → 2000: 25 HPa; n=12)
		- 26 %	
Făgăraș Basin	- 43.82 % (1963: 89 HPa → 1974: 50 HPa; n=5)	- 23.68 % (1974: 38 HPa → 1989: 29 HPa; n=3)	- 20.17 % (1989: 114 HPa → 2000: 91 HPa; n=37)
Sibiu Basin	- 28.3 % (1963: 74 HPa → 1974: 53 HPa; n=11)	- 15.38 % (1974: 52 HPa → 1989: 44 HPa; n=11)	+ 38.63 % (1989: 44 HPa → 2000: 61 HPa; n=11)
		+ 17.3 %	

Table 4.: The population decrease of White Stork in the lower sector of the Făgăraș Basin (based on data published by Klemm (1975b), Philippi and Popa (1990))

Locality	1963	1974	1989	2000
Avrig	12	6	7	2
Racovița	16	12	11	6
Săcădate	18	11	0	1
Scorei	42	20	11	11
Total	88	49	29	20

Table 5. List of localities with White Stork nests in the Upper and Middle Olt River Basin in 1996-2000 (Abbreviations: counties: BV - Braşov, CV- Covasna, HR - Harghita, SB - Sibiu; regions: BIRS - Bârsei Basin, CASI - Căşinu Basin, CIUC - Ciuc Basin, FAGA - Făgăraş Basin, HIRT - Hârtibaci River Basin, HOMO - Homoroad Rivers Basin, SIBI - Sibiu Basin, TSEC - Târgu Secuiesc Basin; Latitude and longitude are expressed in decimal degrees)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZA	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
AGNITA	SB	45.9667	24.6167	35TLL19	500	HIRT	1	1	1					4	4.00	4.00	1							2000
AITA MARE	CV	45.9667	25.5500	35TLL89	474	BIRS	9	7	6	1			2	21	3.00	3.50	1	1	2		5			2000
AITA MEDIE	CV	45.9833	25.5833	35TLL99	513	BIRS	1	1		1					0.00	0.00				1				1997
AITA SEACĂ	CV	46.0333	25.6833	35TLL99	622	BIRS	1	1	1					2	2.00	2.00			1					2000
ALDEA	HR	46.2500	25.4333	35TLM72	640	HOMO	1	1	1					3	3.00	3.00	1							2000
ALTINA	SB	45.9333	24.4667	35TLL08	478	HIRT	1	1	1					1	1.00	1.00								2000
ANINOASA	CV	45.8166	25.9666	35TML17	538	TSEC	1	1			1				0.00	0.00					1			2000
APAŢA	BV	45.9500	25.5167	35TLL88	506	BIRS	15	13	9	4		1	1	31	2.38	3.44	7		4		3			2000
APOŞ	SB	46.0333	24.5500	35TLM10	527	HIRT	1	1	1					4	4.00	4.00	1							2000
ARACI	CV	45.8167	25.6500	35TLL97	506	BIRS	2	2	2					5	2.50	2.50	1					1		2000
ARINI	BV	45.8833	25.5500	35TLL88	489	BIRS	1	1	1					3	3.00	3.00						1		2000
ARIUŞD	CV	45.7833	25.6833	35TLL97	501	BIRS	1	1	1					3	3.00	3.00	1							2000
ARPAŞUL DE JOS	SB	45.7833	24.6167	35TLL17	400	FAGA	2	2			2				0.00	0.00			2					2000
AUGUSTIN	BV	46.0500	25.5500	35TLM80	442	BIRS	1	1	1					5	5.00	5.00	1							1999
AVRIG	SB	45.7167	24.3833	35TKL96	377	FAGA	2	2	2					7	3.50	3.50	1							2000
BĂCEL	CV	45.7667	25.8167	35TML06	506	TSEC	3	3	2		1			5	1.67	2.50	3							1999
BACIU (SĂCEL)	BV	45.6000	25.6667	35TLL95	968	BIRS	1						1		0.00	0.00								1998
BANCU	HR	46.3000	25.9333	35TMM12	691	CIUC	1	1		1					0.00	0.00						1		1998
BARAOLT	CV	46.0833	25.6000	35TLM90	482	BIRS	2	2	2					9	4.50	4.50	1		1					2000
BĂRCUT	BV	46.0000	24.9167	35TLL39	581	HIRT	1	1	1					4	4.00	4.00			1					2000
BĂRGHIŞ	SB	45.9833	24.5333	35TLL09	447	HIRT	2	2	2					9	4.50	4.50								2000
BĂRZAVA	HR	46.4333	25.8167	35TMM04	769	CIUC	1	1	1					5	5.00	5.00	1							2000
BĂŢĂNIU MICI	CV	46.1000	25.7000	35TLM90	518	BIRS	1	1	1					3	3.00	3.00		1						2000
BĂŢĂNIU MARI	CV	46.0833	25.6833	35TLM90	515	BIRS	1	1	1					3	3.00	3.00			1					2000
BECLEAN	BV	45.8333	24.9167	35TLL37	423	FAGA	5	4	4				1	13	3.25	3.25	3			1	1			2000
BEIA	BV	46.1500	25.1833	35TLM51	522	HOMO	2	1	1				1	2	2.00	2.00	1					1		2000

Table 5. (continued)

Census year	Other	Tree	Barn	Roof	Chimney	Pylon with Electric pylon	J2m	J2a	J2G	uH	HE	HPx	HPo	HPm	HPa	H	Region	Altitude (m)	UTM code	Longitude	Latitude	County	Locality
2000								0.00				1				1	TSEC	591	35TMM30	26.1833	46.0833	CV	BELANI
2000		4				1	4.00	4.00	36					9	9	9	BIRS	493	35TLL88	25.5667	45.9333	CV	BELIN
2000		1					2.00	2.00	2					1	1	1	BIRS	591	35TLL98	25.6000	45.9333	CV	BELIN VALE
1996		2					2.50	2.50	5					2	2	2	FAGA	532	35TLL46	24.9833	45.7333	BV	BERIVOI (MARE)
2000						1	3.00	3.00	3					1	1	1	BIRS	495	35TLM90	25.6500	46.0833	CV	BIBORȚENI
2000						1	3.00	3.00	3					1	1	1	TSEC	565	35TML16	25.8667	45.7667	CV	BICFALĂU
2000		11				3	3.31	3.31	43		1			13	13	13	TSEC	525	35TML17	25.9667	45.8333	CV	BITA
2000		1					4.00	4.00	4					1	1	1	TSEC	663	35TMM10	25.8667	46.1000	CV	BIXAD
2000					2	1	4.00	4.00	8		1			2	2	2	BIRS	498	35TLL96	25.6500	45.7667	BV	BOD
1999		1					4.00	4.00	4					1	1	1	TSEC	549	35TML18	25.8500	45.9500	CV	BODOC
2000		1					2.00	2.00	2		1			1	1	1	FAGA	460	35TLL79	25.3500	45.9833	BV	BOGATA OLTEANĂ
2000					1		4.00	4.00	4					1	1	1	SIBI	350	35TKL85	24.2500	45.6333	SB	BOIȚA
2000						3	3.33	3.33	10						3	3	TSEC	564	35TML27	26.0000	45.8167	CV	BOROȘNEU MARE
1997						1	0.00	0.00			1						TSEC	680	35TML27	26.0167	45.7833	CV	BOROȘNEU MIC
2000						1	4.00	4.00	4					1	1	1	HIRT	520	35TLM30	24.8333	46.0833	SB	BRĂDENI
2000				1			5.00	5.00	5					1	1	1	FAGA	338	35TKL96	24.3333	45.7167	SB	BRADU
2000		1					2.00	2.00	4					2	2	2	BIRS	509	35TLM90	25.6167	46.1333	CV	BRĂDUȚI
1996					1		3.00	3.00	3					1	1	1	BIRS	776	35TLL74	25.3500	45.5167	BV	BRAN
2000		2				3	3.17	3.17	19		1			6	6	6	TSEC	529	35TML27	26.0667	45.8333	CV	BRATEȘ
1996		2			1		2.33	2.33	7					3	3	3	FAGA	607	35TLL36	24.8833	45.7000	BV	BREAȚA
2000						2	2.00	2.00	2			1		4	4	4	TSEC	592	35TML49	26.3000	46.0500	CV	BREȚCU
1999				1			2.00	2.00	2					1	1	1	FAGA	514	35TLL28	24.7000	45.8667	SB	BRUJU
1999						1	0.00	0.00				1					FAGA	556	35TLL56	25.0833	45.7333	BV	BUCIUM
2000		1					4.00	4.00	4				1	2	2	2	BIRS	581	35TML05	25.8000	45.6667	BV	BUDILA
1996			1				3.00	3.00	6					2	2	2	FAGA	508	35TLL38	24.9000	45.8667	BV	CĂLBOR
2000					1		3.00	3.00	3					1	1	1	BIRS	468	35TLL89	25.5667	46.0333	CV	CĂPENI
1998						1	2.00	2.00	6					3	3	3	BIRS	597	35TML05	25.7667	45.6500	BV	CĂRPINIȘ
2000					1		3.00	3.00	3					1	1	1	CIUC	735	35TMM05	25.7500	46.5333	HR	CĂRTA

Table 5. (continued)

Census year	Other	Tree	Barn	Roof	Chimney	Pylon with Electric pylon	JZm	JZA	JZG	uH	HE	HPx	HPo	HPm	HPa	H	Region	Altitude (m)	UTM code	Longitude	Latitude	County	Locality
2000	1						4.00	2.00	4				1	1	2	2	FAGA	409	35TLL17	24.5667	45.7833	SB	CÂRȚA
1998							0.00	0.00			1						FAGA	526	35TLL16	24.5833	45.7167	SB	CÂRȚISOARA
1998				1			2.00	2.00	2				1	1	1	1	CASI	698	35TMM21	26.0500	46.2000	HR	CAȘINU NOU
2000							3.00	3.00	3				1	1	1	1	HIRT	405	35TKL87	24.2833	45.7833	SB	CAȘOLT
2000	1						3.00	3.00	3				1	1	1	1	HOMO	442	35TLM60	25.2667	46.0833	BV	CATA
2000						1	0.00	0.00				1					TSEC	551	35TML39	26.1500	45.9666	CV	CATALINA
1997	1					1	2.00	1.00	2				1	1	2	2	TSEC	554	35TML28	26.0333	45.9500	CV	CERNAT
2000			5			7	3.30	2.75	33				2	2	10	12	CIUC	662	35TMM12	25.9000	46.2500	HR	CETĂȚUIA
2000					1	3	2.33	2.33	7	1			3	3	3	4	TSEC	508	35TML07	25.8000	45.7833	CV	CHICHIȘ
2000				1			5.00	5.00	5				1	1	1	1	FAGA	481	35TLL18	24.6000	45.9000	SB	CHIRPĂR
1997			2				2.00	1.00	2				1	1	2	2	TSEC	618	35TML37	26.1500	45.8167	CV	CHIURUȘ
2000						1	5.00	5.00	5				1	1	1	1	CIUC	664	35TMM03	25.8000	46.3500	HR	CIBA
2000			7			1	3.50	2.10	21				4	6	10	10	CIUC	676	35TMM04	25.7833	46.4167	HR	CICEU
1996				1			2.00	2.00	2				1	1	1	1	FAGA	406	35TLL37	24.8333	45.8333	BV	CINCȘOR
1998							0.00	0.00			1						FAGA	458	35TLL28	24.8000	45.9167	BV	CINCU
2000							3.75	3.75	15							4	SIBI	472	35TKL76	24.1500	45.7167	SB	CIȘNĂDIE
2000							3.00	3.00	3				1	1	1	1	SIBI	693	35TKL76	24.1000	45.7000	SB	CIȘNĂDIOARA
1996					1		2.00	2.00	2				1	1	1	1	FAGA	583	35TLL49	25.0500	45.9500	BV	COBOR
2000						3	2.33	2.33	7				3	3	3	3	BIRS	546	35TLL76	25.4500	45.7000	BV	CODLEA
2000				1			0.00	0.00				1				1	BIRS	514	35TLL96	25.6333	45.7667	BV	COLONIA BOD
2000			1			1	3.00	3.00	6				2	2	2	2	FAGA	453	35TLL68	25.2333	45.9167	BV	COMANA DE JOS
2000			1				5.00	5.00	5				1	1	1	1	FAGA	527	35TLL68	25.2667	45.9000	BV	COMANA DE SUS
1996			1				3.00	3.00	3				1	1	1	1	FAGA	532	35TLL46	24.9833	45.7333	BV	COPĂCEL
1997							0.00	0.00			1					1	TSEC	515	35TML07	25.8000	45.8167	CV	COȘENI
2000			3				3.50	3.50	7		1			2	2	3	TSEC	564	35TML37	26.1833	45.8500	CV	COVASNA
1998						2	2.50	2.50	5				2	2	2	2	HIRT	464	35TLL19	24.5667	45.9833	SB	COVEȘ
2000					1		4.00	4.00	4				1	1	1	1	CIUC	676	35TMM11	25.9333	46.2167	HR	COZMENI
2000						2	3.50	3.50	7					2	2	2	HOMO	560	35TLM71	25.4333	46.1833	HR	CRĂCIUNEL

Table 5. (continued)

Census year	Other	Tree	Barn	Roof	Chimney	Pylon with Electric pylon	JZm	JZa	JZG	uH	HE	HPx	HPo	HPm	HPa	H	Region	Altitude (m)	UTM code	Longitude	Latitude	County	Locality
2000		1				1		2.50	2.50	5				2	2	2	FAGA	437	35TLL68	25.2000	45.9167	BV	CRIMALMA
1996	1				1			2.50	2.50	5				2	2	2	BIRS	624	35TLL85	25.4667	45.6167	BV	CRISTIAN
2000					15	14		3.00	2.60	78			4	26	30	30	SIBI	441	35TKL67	24.0333	45.7833	SB	CRISTIAN
1996		1			2			2.33	2.33	7				3	3	3	BIRS	567	35TLL87	25.4667	45.8167	BV	CRIZBAV
1996				2		1		3.33	3.33	10				3	3	3	FAGA	558	35TLL68	25.2667	45.9333	BV	CUCIULATA
2000	1							2.00	2.00	2				1	1	1	HOMO	461	35TLL59	25.1500	46.0167	BV	DACIA
2000								5.00	5.00	5				1	1	1	HIRT	425	35TKL87	24.2833	45.8000	SB	DAIA
2000						1		4.00	4.00	4				1	1	1	FAGA	542	35TLL59	25.1500	45.9667	BV	DĂIȘOARA
1997					1			3.00	3.00	3				1	1	1	TSEC	574	35TML28	25.9833	45.9167	CV	DALNIC
2000		1				2		1.50	3.00	3		1		1	2	3	CIUC	709	35TMM05	25.7500	46.5167	HR	DĂNEȘTI
2000	1			2	3			3.71	3.71	26				7	7	7	HIRT	526	35TLL29	24.7000	45.9833	SB	DEALU FRUMOS
1996				1				2.00	2.00	2				1	1	1	FAGA	570	35TLL36	24.9333	45.7167	BV	DEJANI
2000						1		0.00	0.00				1		1	1	CIUC	721	35TMM14	25.8333	46.4167	HR	DELNIȚA
1999					1			4.00	4.00	4				1	1	1	TSEC	526	35TML07	25.7500	45.7833	CV	DOBOLII DE JOS
1997			1					0.00	0.00			1			1	1	TSEC	581	35TML27	26.0333	45.7833	CV	DOBOLII DE SUS
2000				1	1			2.00	2.00	4				2	2	2	BIRS	509	35TLM90	25.5833	46.1167	CV	DOBOȘENI
2000						1		4.00	4.00	4				1	1	1	FAGA	527	35TLL79	25.3833	45.9833	BV	DOPCA
1999			1					0.00	0.00				1		1	1	FAGA	519	35TLL26	24.7833	45.7500	BV	DRĂGUȘ
2000				1	1			4.50	4.50	9				2	2	2	HOMO	442	35TLM61	25.3000	46.1333	BV	DRĂUȘENI
2000						1		5.00	5.00	5				1	1	1	FAGA	430	35TLL37	24.8833	45.8167	BV	DRIDIF
1996	1				2			2.33	2.33	7				3	3	3	BIRS	520	35TLL76	25.4333	45.7667	BV	DUMBRĂVIȚA
2000						1		0.00	0.00			1			1	1	TSEC	614	35TMM30	26.2166	46.1000	CV	ESTELNIC
1998					1			2.00	2.00	2				1	1	1	FAGA	416	35TLL47	24.9667	45.8500	BV	FĂGĂRAȘ
2000						1		2.00	2.00	2				1	1	1	FAGA	469	35TLL69	25.2833	45.9667	BV	FĂNTĂNA
1996			1					2.00	2.00	2				1	1	1	BIRS	494	35TLL97	25.6000	45.8167	BV	FELDIOARA
2000						1		3.00	3.00	3				1	1	1	FAGA	588	35TLL48	25.0167	45.9333	BV	FELMERU
2000				2				2.00	2.00	2			1	1	2	2	BIRS	522	35TLM91	25.6167	46.1500	CV	FILIA
1996				1				2.00	2.00	2				1	1	1	FAGA	416	35TLL47	24.9667	45.8500	BV	GALAȚI

Table 5. (continued)

Census year	Other	Tree	Barn	Roof	Chimney	Pylon with Electric pylon	Jzm	Jza	Jzg	uH	HE	HPx	HPo	HPm	HPa	H	Region	Altitude (m)	UTM code	Longitude	Latitude	County	Locality
1997							3.00	3.00	3.00						1	1	TSEC	614	35TML48	26.2333	45.9500	CV	GHELINTA
1999							4.00	4.00	4.00						1	1	TSEC	547	35TML18	25.8500	45.9000	CV	GHIDFALĂU
1996	1						2.33	2.33	2.33					3	3	3	BIRS	562	35TLL85	25.5000	45.6667	BV	GHIMBAV
1996					2		3.00	3.00	3.00					4	4	4	HOMO	514	35TLL49	24.9667	46.0333	BV	GRÂNARI
2000							3.00	3.00	3.00					1	1	1	SIBI	545	34TGR36	23.9833	45.7333	SB	GURA RÂULUI
1999		1					2.00	1.00	2.00				1	1	2	2	FAGA	579	35TLL36	24.9000	45.7167	BV	GURA VÂII
2000			6				3.40	3.40	1		1	1		5	5	7	BIRS	506	35TLL87	25.5833	45.8333	CV	HĂGHIG
1996				1			2.00	2.00						1	1	1	BIRS	511	35TLL86	25.5500	45.7667	BV	HÂLCHIU
2000							5.00	5.00	1						1	1	FAGA	438	35TLL58	25.1167	45.8667	BV	HÂLMEAG
2000			1				2.00	2.00						1	1	1	SIBI	532	35TKL88	24.2000	45.8667	SB	HAMBA
2000				1			4.00	4.00						1	1	1	BIRS	525	35TLL96	25.6833	45.7167	BV	HÂRMAN
1999							4.00	4.00	1					1	1	1	FAGA	539	35TLL46	25.0167	45.7500	BV	HÂRSENI
2000			1				4.00	4.00						1	1	1	TSEC	552	35TML38	26.1333	45.9333	CV	HÂTUICA
2000				1			4.00	4.00						1	1	1	BIRS	581	35TLM90	25.7000	46.1333	CV	HERCULIAN
1997			1				0.00	0.00					1			1	TSEC	768	35TML49	26.2333	45.9667	CV	IIILIB
2000			5				3.50	3.00	1				1	6	7	7	FAGA	490	35TLL69	25.3000	45.9833	BV	HOGHIZ
2000				2			4.00	4.00						2	2	2	HOMO	431	35TLM60	25.2667	46.0500	BV	HOMOROD
1996				1			2.00	2.00						1	1	1	FAGA	454	35TLL47	24.9500	45.8000	BV	HUREZ
1997							4.00	4.00	1					1	1	1	CASI	736	35TMM31	26.1000	46.2000	HR	IACOBENI
2000							4.00	4.00						1	1	1	HIRT	467	35TLM20	24.7167	46.0500	SB	IACOBENI
1996			1				1.00	1.00						1	1	1	FAGA	493	35TLL37	24.9333	45.7667	BV	IAȘI
2000							0.00	0.00	1					1	1	1	HIRT	497	35TLL09	24.4833	45.9833	SB	IGHIȘU VECHI
1999			1				3.00	1.50	3.00				1	1	2	2	TSEC	538	35TML07	25.7667	45.8000	CV	ILIENI
1997			1				2.00	1.00	1				1	1	2	2	TSEC	553	35TML38	26.1667	45.9500	CV	IMENI
2000							3.00	3.00	1					1	1	1	CIUC	709	35TMM05	25.7667	46.5500	HR	INEU
2000			1				0.00	0.00						1	1	1	HOMO	517	35TLM71	25.3333	46.1500	BV	IONEȘTI
2000							3.00	3.00						1	1	1	HOMO	503	35TLL59	25.0667	46.0000	BV	JIBERT
2000			1				5.00	5.00							1	1	CIUC	680	35TMM03	25.8167	46.3333	HR	JIGODIN

Table 5. (continued)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
JIMBOR	BV	46.1000	25.3833	35TLM70	557	HOMO	1	1	1					4	4.00	4.00			1					2000
LELIČENI	HR	46.3500	25.8500	35TMM13	720	CIUC	1	1	1					3	3.00	3.00					1			2000
LEMNIA	CV	46.0500	26.2667	35TML49	590	TSEC	25	21	14	6	1	1	3	45	2.14	3.21	8	10			7			2000
LET	CV	45.8500	26.0167	35TML27	528	TSEC	1	1	1					4	4.00	4.00				1				1997
LISA	BV	45.7167	24.8500	35TLL36	555	FAGA	1	1			1				0.00	0.00	1							1999
LISNĂU	CV	45.7833	25.8833	35TML17	576	TSEC	1	1	1					2	2.00	2.00					1			1997
LOVNIC	BV	45.9833	25.0167	35TLL49	634	HOMO	2	2	2					5	2.50	2.50								2000
LUDIȘOR	BV	45.7667	24.8833	35TLL37	491	FAGA	1	1	1					4	4.00	4.00	1							2000
LUETA	HR	46.2667	25.4833	35TLM82	634	HOMO	1	1		1					0.00	0.00	1							2000
LUNCA CĂLNICULUI	BV	45.7667	25.7667	35TML06	500	BIRS	3	2	2				1	6	3.00	3.00	3							2000
LUNCA OZUNULUI	CV	45.8000	25.8500	35TML17	509	TSEC	1					1			0.00	0.00	1							1997
LUNGA	CV	46.0333	26.2167	35TML39	565	TSEC	3	3	3					10	3.33	3.33	1				2			2000
LUTA	BV	45.8000	24.9000	35TLL37	451	FAGA	1	1	1					4	4.00	4.00	1							2000
LUTOASA	CV	46.0833	26.2333	35TMM40	596	TSEC	1	1	1					3	3.00	3.00	1							2000
MĂDĂRAȘ	HR	46.5000	25.7500	35TMM05	710	CIUC	3	3	2	1				7	2.33	3.50	2				1			2000
MĂGHERUȘ	CV	45.7833	25.9167	35TML17	574	TSEC	1	1	1					4	4.00	4.00						1		2000
MĂIERUȘ	BV	45.9000	25.5333	35TLL88	477	BIRS	1	1	1					4	4.00	4.00	1							2000
MĂLINIȘ	BV	45.7500	25.0167	35TLL46	539	FAGA	2	2	2					5	2.50	2.50			2					1996
MALNAȘ	CV	46.0167	25.8333	35TML09	572	TSEC	1	1	1					3	3.00	3.00					1			2000
MÂNDRA	BV	45.8167	25.0500	35TLL47	466	FAGA	2	2	1		1			3	1.50	3.00	1		1					2000
MÂRCUȘA	CV	45.9167	26.0500	35TML28	554	TSEC	1	1		1					0.00	0.00	1							1997
MĂRGINENI	BV	45.7167	25.0500	35TLL46	612	FAGA	2	1	1				1	4	4.00	4.00	1					1		1999
MARPOD	SB	45.8667	24.5000	35TLL08	502	HIRT	2	2	2					7	3.50	3.50	2							2000
MĂRTĂNUȘ	CV	46.0167	26.2833	35TML49	605	TSEC	1	1	1					5	5.00	5.00	1							2000
MĂRTINENI	CV	45.9166	26.1000	35TML38	541	TSEC	2	2			2				0.00	0.00	1		1					2000
MĂRTINIȘ	HR	46.2333	25.3833	35TLM72	480	HOMO	1	1	1					4	4.00	4.00		1						2000
MATEIAȘ	BV	46.0167	25.3667	35TLL79	452	FAGA	3	3	3					10	3.33	3.33	2		1					2000

Table 5. (continued)

Census year	Other	Tree	Barn	Roof	Chimney	Pylon with	Electric pylon	Jzm	Jza	Jzg	uH	HE	HPx	HPo	HPm	HPa	H	Region	Altitude (m)	UTM code	Longitude	Latitude	County	Locality
2000									0.00	1.50	3		2			2	2	HOMO	459	35TLM70	25.3333	46.0667	BV	MERCHEAȘA
2000							1	4.00	4.00	4					1	1	1	HOMO	592	35TLM82	25.4500	46.2333	HR	MEREȘTI
2000				1				4.00	4.00	4					1	1	1	HIRT	481	35TLL29	24.7333	45.9667	SB	MERGHINDEAL
2000					1			2.00	2.00	2					1	1	1	TSEC	610	35TMM00	25.8333	46.0500	CV	MICFALĂU
2000			1		1			4.00	4.00	12					3	3	3	BIRS	480	35TLL89	25.5667	46.0167	CV	MICLOȘOARA
2000			1			1		4.00	4.00	4			1	1	1	1	2	CIUC	664	35TMM03	25.8000	46.3500	HR	MIERCUREA CIUC
1997							2	2.50	2.50	5			2	2	2	2	2	TSEC	553	35TML17	25.9667	45.8667	CV	MOACȘA
1996							1	2.00	2.00	2					1	1	1	BIRS	978	35TLL63	25.3333	45.4833	BV	MOECIU
2000								4.00	4.00	4					1	1	1	SIBI	463	35TKL86	24.2333	45.7333	SB	MOHU
1998				1				3.00	3.00	3					1	1	1	HIRT	525	35TLL29	24.7833	46.0167	SB	MOVILE
2000			1					3.00	3.00	3					1	1	1	CIUC	770	35TMM14	25.8333	46.4833	HR	NĂDEJDEA
2000						1		3.00	3.00	3					1	1	1	HIRT	486	35TLM20	24.7833	46.0500	SB	NETUȘ
2000								3.67	3.67	22					6	6	6	HIRT	433	35TLL08	24.4500	45.9000	SB	NOCRICH
2000					1			3.00	3.00	3					1	1	1	HIRT	456	35TKL87	24.2833	45.8333	SB	NOUL
1996								2.00	2.00	2					1	1	1	HIRT	442	35TKL97	24.3833	45.8000	SB	NUCET
2000						1		0.00	0.00		1							HOMO	497	35TLM71	25.4167	46.1667	HR	OCLAND
1999							1	0.00	0.00				1			1		FAGA	470	35TLL56	25.1500	45.7667	BV	OHABA
2000						1		4.00	4.00	4					1	1	1	TSEC	562	35TML19	25.8500	45.9667	CV	OLTENI
2000							3	3.33	3.33	10					3	3	3	FAGA	428	35TLL27	24.7667	45.8000	BV	OLTET
2000				1				5.00	5.00	5					1	1	1	HOMO	466	35TLM71	25.3500	46.1667	HR	ORĂȘENI
2000			1		4	1		3.10	2.82	31				1	10	11	11	SIBI	512	34TGR37	23.9667	45.7500	SB	ORLAT
1999					1			0.00	0.00						1	1	1	BIRS	459	35TLL89	25.5500	46.0167	BV	ORMEȘ
2000				1	1	4		3.00	3.00	27					9	9	9	TSEC	515	35TML17	25.8500	45.8000	CV	OZUN
2000			14					3.35	2.85	57	1	1	1	1	2	17	20	TSEC	540	35TML37	26.1167	45.8167	CV	PACHIA
1996			1					3.00	3.00	3					1	1	1	FAGA	526	35TLL66	25.2333	45.7000	BV	PALTIN
1999							1	0.00	0.00					1				TSEC	562	35TML37	26.1333	45.7833	CV	PĂPĂUȚI
1998			1		1		1	2.33	2.33	7					3	3	3	FAGA	448	35TLL57	25.1833	45.8500	BV	PĂRĂU
1997	1							2.00	2.00	2					1	1	1	CIUC	738	35TMM13	25.8333	46.4000	HR	PĂULENI CIUC

Table 5. (continued)

Census year	Other	Tree	Barn	Roof	Chimney	Pylon with	Electric pylon	Jzm	Jza	Jzg	uH	HE	HPx	HPo	HPm	HPa	H	Region	Altitude (m)	UTM code	Longitude	Latitude	County	Locality
2000							1	4.00	4.00	4					1	1	1	TSEC	606	35TML38	26.1833	45.8833	CV	PAVA
2000							1	4.00	4.00	4					1	1	1	HIRT	541	35TLM00	24.5167	46.0500	SB	PELIȘOR
1996				1				2.50	2.50	5					2	2	2	FAGA	559	35TLL67	25.2167	45.7833	BV	PERSANI
1997							2	2.50	2.50	5					2	2	2	TSEC	561	35TML38	26.1333	45.9167	CV	PETENI
2000			1					4.00	4.00	4					1	1	1	HOMO	525	35TLM71	25.6833	45.7167	HR	PETRENI
1997				1				2.00	2.00	2					1	1	1	CASI	725	35TMM32	26.1000	46.2333	HR	PLĂIEȘII DE SUS
1999				1				0.00	0.00				1			1		BIRS	525	35TLL96	25.6833	45.7167	BV	PODU' OLTULUI
1997						1		0.00	0.00					1		1		TSEC	593	35TMM30	26.1500	46.0667	CV	POIAN
1996			1		1			2.50	2.50	5					2	2	2	FAGA	516	35TLL36	24.8667	45.7500	BV	POJORTA
2000								3.00	3.00	3					1	1	1	SIBI	516	35TKL76	24.0500	45.7167	SB	POPLACA
2000					2			2.00	2.00	2				1	1	2	2	FAGA	404	35TLL06	24.4500	45.7500	SB	PORUMBACUL DE JOS
2000			1	5		2		3.14	3.14	44	2	2			14	14	18	BIRS	524	35TML06	25.7667	45.7167	BV	PREJMER
2000								4.00	4.00						1	1	1	FAGA	475	35TLL79	25.4000	46.0333	BV	RACȘUL DE JOS
2000					1			3.00	3.00	6					2	2	2	BIRS	479	35TLM80	25.5333	46.0833	CV	RACȘUL DE SUS
2000			1					3.20	3.20	16			1		5	6	6	FAGA	414	35TKL96	24.3500	45.6833	SB	RACOVITA
2000							1	2.00	2.00	2					1	1	1	CIUC	712	35TMM04	25.7500	46.4500	HR	RACU
2000								3.00	3.00	3					1	1	1	HOMO	491	35TLM71	25.3833	46.2000	HR	RAREȘ
2000					1			3.00	3.00	3					1	1	1	SIBI	677	35TKL76	24.0667	45.7000	SB	RĂȘINARI
1996			1	1				2.50	2.50	5					2	2	2	BIRS	684	35TLL74	25.4500	45.5833	BV	RĂȘNOV
1999							2	4.00	4.00	4				1	1	2	2	FAGA	570	35TLL36	24.9333	45.7167	BV	RECEA
2000							1	2.00	2.00	2					1	1	1	TSEC	548	35TML17	25.9333	45.8500	CV	RECI
1999								3.00	3.00	3					1	1	1	HIRT	465	35TLM30	24.8500	46.0500	SB	REȚIȘU
2000					1			3.00	3.00	3					1	1	1	FAGA	474	35TLL38	24.8667	45.9167	BV	RODBAV
2000								4.00	4.00	4					1	1	1	HIRT	422	35TKL97	24.3167	45.8167	SB	ROȘIA SĂSEASCĂ
2000								3.50	3.50	7					2	2	2	BIRS	509	35TLL87	25.5500	45.8333	BV	ROTBAV
2000				1				3.00	3.00	3					1	1	1	FAGA	402	35TLL27	24.7667	45.8167	BV	RUCĂR
2000								3.00	3.00	3					1	1	1	HOMO	471	35TLL69	25.2167	46.0333	BV	RUPEA
1996								1.00	1.00	1					1	1	1	SIBI	440	35TKL67	24.0333	45.8167	SB	RUȘCIORI

Table 5. (continued)

Census year	Other	Tree	Barn	Roof	Chimney	Pylon with	Electric pylon	Jzm	Jza	Jzg	uH	HE	HPx	HPo	HPm	HPa	H	Region	Altitude (m)	UTM code	Longitude	Latitude	County	Locality
2000									4.00	4.00							1	FAGA	394	35TKL97	24.3833	45.7667	SB	SĂCĂDATE
2000							1		4.00	4.00	8						2	SIBI	516	34TGR27	23.9333	45.7833	SB	SĂCEL
2000					2			2.50	2.50								2	BIRS	687	35TLL95	25.6833	45.6167	BV	SĂCELE
1997							1		3.00	3.00	3						1	TSEC	649	35TML17	25.9500	45.7833	CV	SĂCIOVA
2000								3.00	3.00								1	SIBI	637	35TKL86	24.1833	45.6667	SB	SADUL
2000							2		2.00	2.00	4						2	SIBI	607	34TGR27	23.8833	45.7833	SB	SĂLIȘTE
1996				1				1.50	1.50		3						2	FAGA	426	35TLL37	24.8167	45.8000	BV	SĂMBĂTA DE JOS
2000			4			3		3.57	3.57		25						7	FAGA	512	35TLL36	24.8167	45.7500	BV	SĂMBĂTA DE SUS
2000			2			2		5.00	5.00		1						4	CIUC	659	35TMM12	25.8500	46.3000	HR	SĂNCRĂIENI
2000				1				5.00	5.00								1	CIUC	757	35TMM05	25.7833	46.5833	HR	SÂNDOMINIC
2000						1		4.00	4.00								1	CIUC	676	35TMM12	25.9333	46.2667	HR	SĂNMARTIN
2000				1	1	5	11	3.20	2.67	48							18	HOMO	472	35TLM71	25.3833	46.1833	HR	SĂNPAUL
1996				2	1			2.00	2.00		1						3	BIRS	535	35TLL96	25.6333	45.7167	BV	SĂNPETRU
2000			8					3.38	3.00	81							27	CIUC	646	35TMM12	25.8833	46.2500	HR	SĂNSIMION
2000			3			3	2	3.67	3.67	22	2						8	CIUC	652	35TMM12	25.8667	46.2833	HR	SĂNTIMBRU
2000			2			1	2	3.00	3.00	15							5	TSEC	525	35TML17	25.8667	45.8167	CV	SĂNTION LUNCA
1997					1			3.00	3.00		3						1	TSEC	593	35TML39	26.1333	46.0500	CV	SĂNZIENI
1996								2.00	2.00								1	FAGA	442	35TLL06	24.5000	45.7333	SB	SĂRATA
2000			1					0.00	0.00				1				1	FAGA	567	35TLL18	24.6000	45.8500	SB	SĂSĂUȘI
2000					3			4.00	4.00	12							3	BIRS	517	35TLL86	25.5167	45.7667	BV	SATU NOU
2000						1		3.00	3.00								1	HOMO	507	35TLM71	25.4000	46.1500	HR	SATU NOU
2000							6	3.25	2.36	26	1			3			12	FAGA	450	35TLL06	24.5333	45.7500	SB	SCOREI
2000							1	2.00	2.00								1	SIBI	507	35TKL95	24.3333	45.6500	SB	SEBEȘUL DE JOS
2000								4.00	4.00								1	FAGA	489	35TKL95	24.3500	45.6500	SB	SEBEȘUL DE SUS
2000					1			4.00	4.00								1	SIBI	379	35TKL87	24.2000	45.7667	SB	ȘELIMBĂR
2000						1		3.50	3.50								2	HIRT	567	35TLL39	24.8500	45.9833	BV	ȘELISIAȚ
2000					3		3	3.60	3.60		1						6	FAGA	444	35TLL57	25.1333	45.8500	BV	ȘERCAIA
1999							1	0.00	0.00								1	FAGA	538	35TLL56	25.1167	45.7333	BV	ȘERCĂIȚA

Table 5. (continued)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
SFÂNTU GHEORGHE	CV	45.8667	25.7833	35TML07	510	TSEC	1	1		1					0.00	0.00			1					1998
ȘIBIU	SB	45.8000	24.1500	35TKL77	401	SIBI	6	6	6					17	2.83	2.83								2000
SICULENI	HR	46.4167	25.7500	35TMM04	677	CIUC	11	8	7	1		1	2	23	2.88	3.29	2	5			3	1		2000
ȘINCA VECHE	BV	45.7667	25.1667	35TLL56	479	FAGA	1	1	1					4	4.00	4.00			1					2000
ȘOARȘ	BV	45.9333	24.9167	35TLL38	488	FAGA	2	2	2					8	4.00	4.00	1		1					2000
ȘONA	BV	45.8500	25.0500	35TLL47	430	FAGA	1	1	1					2	2.00	2.00	1							2000
ȘTUPINI	BV	45.7000	25.5667	35TLL86	527	BIRS	2	2	2					5	2.50	2.50			1	1				1996
ȘUMULEU-CIUC	HR	46.3833	25.8333	35TMM13	814	CIUC	1						1		0.00	0.00			1					2000
ȘURA MARE	SB	45.8500	24.1667	35TKL88	461	SIBI	1	1	1					3	3.00	3.00			1					2000
ȘURA MICĂ	SB	45.8667	24.0667	35TKL78	402	SIBI	2	2	2					8	4.00	4.00								2000
SURCEA	CV	45.8833	26.0833	35TML28	536	TSEC	2	2	1	1				4	2.00	4.00	1				1			2000
SZASZFALU (LUNGA)	CV	46.0167	26.2000	35TML39	562	TSEC	1	1	1					3	3.00	3.00	1							2000
TĂLIȘOARA	CV	46.1000	25.5833	35TLM90	494	BIRS	3	2	1	1			1	4	2.00	4.00			3					2000
TĂLMACIU	SB	45.6500	24.2667	35TKL85	418	SIBI	2	2	1	1				5	2.50	5.00	1		1					2000
TAMAȘFALĂU	CV	45.8833	26.1167	35TML38	541	TSEC	2	2	2					5	2.50	2.50	2							2000
TÂRGU SECUIESC	CV	46.0000	26.1333	35TML39	570	TSEC	1	1	1					2	2.00	2.00			1					2000
TELECHIA	CV	45.8666	26.0333	35TML27	534	TSEC	1	1	1					4	4.00	4.00	1							2000
TELIU	BV	45.7000	25.8500	35TML16	622	BIRS	1	1	1					2	2.00	2.00				1				1996
TICUȘUL VECI	BV	45.9333	25.1000	35TLL58	485	FAGA	2	2	1	1				2	1.00	2.00								1999
TINOASA	CV	46.0000	26.1833	35TML39	560	TSEC	6	6	5	1				15	2.50	3.00	4				1	1		2000
TOARCLA	BV	45.9000	24.7333	35TLL28	461	FAGA	1	1	1					4	4.00	4.00	1							2000
TODERIȚA	BV	45.7833	25.0667	35TLL47	495	FAGA	4	4	4					10	2.50	2.50			1		3			1996
TOHANU NOU	BV	45.5500	25.3833	35TLL74	719	BIRS	1	1	1					2	2.00	2.00			1					1996
TOHANU VECI	BV	45.5667	25.3667	35TLL74	705	FAGA	1	1	1					3	3.00	3.00	1							1996
TOPLIȚA-CIUC	HR	46.3666	25.8000	35TMM03	673	CIUC	2	1	1				1	3	3.00	3.00	2							2000
ȚUFALĂU	CV	45.8333	26.0167	35TML27	528	TSEC	3	3	2	1				6	2.00	3.00	1	2						2000
ȚURIA	CV	46.0167	26.1500	35TML39	616	TSEC	2	2	2					9	4.50	4.50		2						2000
ȚURNU ROȘU	SB	45.6333	24.3000	35TKL85	618	FAGA	1	1	1					2	2.00	2.00						1		2000

Table 5. (continued)

Census year	Other	Tree	Bam	Roof	Chimney	Pylon with Electric pylon	Jzm	Jza	JZG	uH	HE	HPx	HPo	HPm	HPa	H	Region	Altitude (m)	UTM code	Longitude	Latitude	County	Locality
2000			5			1	3.67	3.67	22						6	6	CIUC	672	35TMM11	25.9000	46.2167	HR	TUȘNAD
2000					1	3	3.00	1.50	6	1		1	1	2	4	5	CIUC	655	35TMM11	25.8833	46.2000	HR	TUȘNADU NOU
2000						1	0.00	0.00		1					1		FAGA	425	35TLL17	24.6667	45.7833	BV	UCEA DE JOS
2000			1				4.00	4.00	4	1				1	1	2	FAGA	510	35TLL16	24.6833	45.7500	BV	UCEA DE SUS
2000					2		3.00	3.00	18					6	6	6	FAGA	457	35TLL69	25.2667	45.9833	BV	UNGRA
2000			2			1	3.00	3.00	6	1					2	3	FAGA	475	35TLL57	25.1333	45.7833	BV	VAD
1999					1		3.00	3.00	3					1	1	1	TSEC	606	35TML08	25.7833	45.9167	CV	VALEA CRIȘULUI
2000					1	1	0.00	0.00				1	1		2	2	TSEC	622	35TMM30	26.1166	46.0833	CV	VALEA SEACĂ
2000					1		4.00	4.00	4					1	1	1	HIRT	489	35TLL19	24.6000	45.9500	SB	VÂRD
2000					1		3.50	3.50	7					2	2	2	BIRS	498	35TLM80	25.5333	46.1333	CV	VÂRGHIȘ
2000			6		2	4	3.30	3.00	33	1			1	10	11	12	FAGA	466	35TLL68	25.2000	45.8667	BV	VENETIA
2000							4.00	4.00	4					1	1	1	SIBI	366	35TKL86	24.2333	45.7167	SB	VEȘTEM
2000					1		2.00	2.00	2					1	1	1	FAGA	541	35TLL16	24.6833	45.7333	BV	VICTORIA
1996					1		1.00	1.00	1					1	1	1	HOMO	577	35TLM50	25.0833	46.0500	BV	VISCRI
1996					2	2	2.00	2.00	8					4	4	4	FAGA	443	35TLL27	24.7333	45.7833	BV	VIȘTEA DE JOS
1999						1	0.00	0.00				1			1	1	FAGA	544	35TLL26	24.7500	45.7333	BV	VIȘTEA DE SUS
1996					1		3.00	3.00	3					1	1	1	BIRS	573	35TLL76	25.3667	45.7667	BV	VLĂDENI
2000						1	3.00	3.00	3					1	1	1	HOMO	827	35TLM83	25.5167	46.3500	HR	VLĂHIȚA NOUĂ
1996			1				3.00	3.00	9					3	3	3	FAGA	420	35TLL37	24.8500	45.8167	BV	VOILA
2000					1		3.00	3.00	3					1	1	1	FAGA	466	35TLL37	24.8667	45.7833	BV	VOIVODENII MARI
2000							0.00	0.00				1			1	1	CIUC	655	35TMM11	25.9167	46.2167	HR	VRABIA
2000					1		2.00	2.00	6					3	3	3	BIRS	599	35TLL75	25.4167	45.6333	BV	VULCAN
2000						1	5.00	5.00	5					1	1	1	HIRT	531	35TKL97	24.3500	45.8000	SB	VURPĂR
2000						1	4.00	4.00	4					1	1	1	TSEC	571	35TML38	26.1833	45.9000	CV	ZĂBALA
1997							0.00	0.00					1		1	1	TSEC	638	35TML08	25.8167	45.9500	CV	ZĂLAN
1996					3		2.00	2.00	8					4	4	4	BIRS	776	35TLL64	25.3000	45.5500	BV	ZĂRNEȘTI
1999							4.00	4.00	4					1	1	1	TSEC	553	35TML18	25.8500	45.9333	CV	ZOLTAN
														</									

Acknowledgements

We are grateful to Béldi Miklós, Molnár Lidia, Dr. Szabó József and Dénes Emese for providing some unpublished White Stork breeding data.

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