White Storks in Armenia: population, trend, and relationships to humans

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Zusammenfassung

Zwischen 2005 und 2007 sammelten wir in Armenien Daten von 993 Weißstorchnestern. Die meisten Nester befanden sich in der Ararat Niederung (87% der Nester im Jahr 2007). Die Zahl der Brutpaare stieg von 548 HPa im Jahr 2005 auf 601 HPa 2006 und 624 HPa 2007 an. Der Brutbestand während des letzten Weißstorchzensus im Jahr 1984 war mit 668 HPa höher. Dies wird mit möglichen Doppelzählungen von Nestern im Jahr 1984 in Verbindung gebracht. Es kann sich aber auch um einen realen Rückgang infolge der Zerstörung von Feuchtgebieten in der Zeit der Sowjetunion handeln.

Der durchschnittliche Reproduktionserfolg (JZa) lag zwischen 2,33 und 2,59 Jungen pro Nest. Die Anzahl von flüggen Jungvögeln pro Nest stieg an: die Anzahl von Nestern mit vier flüggen Jungvögeln hat zugenommen (63 – 2005; 98 – 2006 und 125 – 2007), während die Anzahl mit nur zwei Jungen abgenommen hat (195 - 2005; 165 - 2006 und 150 - 2007).

Die Nistplatzwahl hat sich seit 1984 verändert. Im Zeitraum zwischen 2005 und 2007 wurden 818 Nester (82,4%) auf elektrischen Strommasten gefunden, während es noch 1984 nur 335 Nester (50,1%) waren. Während der Untersuchungszeit wurden 115 Nester zerstört, davon 61 Nester (53%) durch Wind und 25 Nester (21,7%) durch Feuer infolge eines elektrischen Kurzschlusses. Storchennester, die auf Hausdächern gebaut wurden, blockierten die Regenwasserrinnen und verursachten so Schäden an der Bausubstanz des Hauses. Die Schutzmaßnahmen zielten darauf ab, das Verhältnis zwischen den Weißstörchen und den Menschen zu verbessern. So wurden spezielle Nestplattformen für Häuser aufgestellt und verletzte Störche gepflegt. Außerdem wurde mithilfe einer intensiven Öffentlichkeitsarbeit versucht, den Weißstorch wieder als ein nationales Symbol von Armenien zu etablieren.

Summary

During 2005-2007 we collected data on 993 nests of White Storks in Armenia, most of which (87.0% of pairs in 2007) are found in the Ararat plain. In the years 2005-2007 we recorded an increase in the number of Storks: in 2005, 2006, and 2007 we have recorded 548, 601, and 624 pairs respectively. The number of pairs counted during the previous census in 1984 was higher (668 pairs), and it is unclear: is it result of possible duplcation during the 1984 count as a result of erros in methodology, or a real decrease might have been caused by wetland degradation during the Soviet period.

Over the 3 years, the mean productivity ranged from 2.33 to 2.59 young fledged per nest. The number of young fledged per nest has increased: the number of nests with four fledglings has increased (63 in 2005, 98 in 2006 and 125 in 2007), while the number of nests fledging only two young has decreased (195 in 2005, 165 in 2006 and 150 in 2007).

Nest site choice has also changed: in 2005-2007, 818 (82.4% out of total number of observed nests) nests were placed on pylons, compared with only 335 nests (50.1% out of total number of observed nests) in 1984. During the study period, 115 nests were destroyed: of these, 61 nests (53%) were destroyed by wind and 25 nests (21.7%) by fire (due to electrical short circuit). Nests placed on roofs of houses cause damage by blocking the drainage pipes in the roofs. Conservation measures were directed at improving the relationship between humans and storks, by providing special nest-platforms for the roofs of houses, rehabilitating injured Storks, and recreating the Storks as a national symbol of Armenia.

Methods

The research data were collected during 2005 – 2008. The study area includes the Ararat, Armavir, Aragatsotn, Yerevan, Lori, Shirak and Vayots Dzor *marzes* (regions) of Armenia (see map on Fig. 1). Data collection involved 167 expeditions lasting a total of 245 days. In total, we visited 245 locations, and detected nests in 116 of them.

Data from 983 White Stork nests were collected during our visits in the spring-summer season, via direct observations and with the assistance of village inhabitants ("nest neighbors"). Usually, nest neighbors are those people who live closest to the storks' nests.

To determine the number of White Storks in Armenia we used the method of complete counts by mapping each nest site. For every nest we have fixed the following data:

- Geographical coordinates using GPS "Garmin 60CSx"; nests were classified as located on pylons or high-tension electricity pylons, building roofs, trees, waterworks, statues, and cranes.
- Number of adult storks occupying the nest, and number of fledglings.
- Contact details for the "nest neighbors" (name and phone number)

- The year of construction of the current nest, the number of young, and frequency of accidents to nests were all detailed with the help of "nest neighbors", who also recorded causes of nest destruction (wind, nest burning by electricity wires, etc), falls of nestlings and eggs from their nests, and deaths of adult storks, etc.

- Details of any cases of conflict between storks and people in the village.

The data collected by researchers and students from the Acopian Center for the Environment (ACE) were recorded on special forms, while the observations of nest neighbors were recorded on wall-calendars (Fig. 2) designed for our current study. Each censused nest was numbered with a special label to assist with future monitoring (Fig. 3).

The combined methods of direct counting and data recorded by "nest neighbors" allowed us to count almost all the nests in Armenia, and to obtain comprehensive informations about breeding times, and breeding success.

The collected data were stored in a Microsoft Access 2003 database (Microsoft Office 2003) for further data analysis. Statistical analyses were carried out using Excel 2003 (MS Office 2003) and SPSS 11.0 for Windows (SPSS Inc., Chicago, II). The analyses included calculating mean breeding success and standard deviations. Mapping and spatial analysis were conducted with ArcGIS GIS 9.2 (ESRI, Redlands, CA).

Results of the census 2005 - 2007

A total of 993 nests were detected during 2005-2007 in the Ararat, Armavir, Vayoc Dzor, Shirak, Lori, Aragatsotn and Yerevan *marzes* (regions) of Republic of Armenia. Of these, 548 were occupied by pairs and 32 by single birds in 2005, 601 by pairs and 36 by single birds in 2006, and 624 by pairs and 21 by single birds in 2007.

Distribution of White Storks in Armenia was not uniform (Fig.4). Most of the nests are situated in the Ararat valley (543 pairs, 87.0% in 2007), while several small subpopulations inhabit Shirak (26 pairs, 4.2%) and Lori (40 pairs, 6.4%) plateaus and Arpa river valley (15 pairs, 2.4%).

The total output of fledglings in 2005 was 1,310 (from 545 nests), 1,385 (from 594 nests) in 2006, and 1,615 (from 623 nests) in 2007. Mean productivity (JZa = young fledged per pair ± SD) was 2.40±1.07 in 2005, 2.33±1.29 in 2006 and 2.59±1.26 in 2007 (Fig. 5).

Figure 5 shows an increasing trend in the number of young fledged per nest: the proportion of nests with 4 fledglings is increasing, while the proportion of nests with 2 fledglings is decreasing.

Development of the breeding population

Prior to our study, White Storks had been studied in Armenia in 1984 (ADAMIAN 1990). The results of both studies regarding distribution and abundance are presented in Table 1.

The data comparison suggests that there was some decrease in the breeding population of White Storks in Armenia after 1984, but an increasing trend during 2005-7. However, the apparent decrease may be a result of differences in the methods used for the two surveys. The 1984 study (ADAMIAN 1990) was carried out by post: the author sent out simple questionnaires by post, with a request for these to be completed and returned. Using this method it is hard to avoid duplication of data. By contrast, our study was carried out by mapping and providing actual counts of nests, which means that there is no duplication and only a very low likelihood of missing a nest. The increase during 2005-2007 may be due to a short-term fluctuation, or part of a longer-term trend. To determine the specific cause we need longer-term (at least 10-15 years) monitoring of population.

The comparison of mean annual productivity throughout Armenia (Tab. 2) shows that the average number of fledglings per nest ranged from 2.33 to 2.59. In general, mean productivity appears to be stable, with fluctuations in some years (e.g. in 2006), which may be related to the abundance of prey species, but conclusions regarding general trends of breeding performance require longer-term monitoring to be carried out.

Nest locations

In Armenia, White Storks build their nests on electricity pylons, roofs, trees, and sometimes even on monuments or non-operational cranes. We analyzed data for 993 nests (Tab. 3) and determined that White Storks mostly breed on various types of electricity pylons (82.4%), including: regular wood and concrete pylons; railway pylons; and high voltage iron pylons (Fig. 6).

The second most frequent nest locations are roofs: storks place nests on roofs of schools and local administration buildings (usually the tallest buildings in the village), as well as on roofs of private houses. By building nests on roofs, storks can cause serious damage to houses, since they generally place nests on drainage system pipes that can then become blocked. The result is that moisture accumulates in the walls causing damage to homes (Fig. 7).

Comparison of our data with data collected in 1984 (ADAMIAN 1990) suggests that, over the years, storks have shifted their preferred nest locations from roofs to pylons. Nest sites on pylons are vulnerable to fire (caused by short circuits), or wind. During 2005-2007, we recorded 115 cases of nest damage. 61 nests (53%) were destroyed by wind, and 25 nests (21.7%) by fire. Damage to nests was relatively low in 2005 (25 cases), but higher in 2006 (37 cases) and 2007 (35 cases).

Conservation and rehabilitation

It is widely known that storks throw some of their young out of the nest (HORNBERGER 1967, SAMUSENKO & SAMUSENKO 1990). In Armenia, storks also frequently become injured by electricity and telephone wires. In such cases, local inhabitants wish to help them and to find a responsible organization which can care for the injured storks. Our centre has established a programme within the framework of our White Stork conservation project to provide the necessary assistance. Since all nests have numbered labels that also provide our contact information, vil-

lagers can contact us when an accident has occurred. We travel to the village and take the birds to the Biodiversity Center of the Yerevan Botanical Garden, where they receive any necessary veterinary assistance and care until their full recovery. Storks showing adequate recovery are released back into the wild. In 2006-2007, we rehabilitated and released 11 storks.

As mentioned above, storks can damage by placing their nests on the roofs. Although local villagers may be upset by such damage, they still avoid destroying the nests, due to a superstition of "damnation for the nest-destroyers". Thus, in this case, people tolerate damage but cannot take measures to eliminate its source. To solve this problem, we have suggested that they use a special nest platform, which will help to preserve the nests located on the roofs of buildings, while at the same time not interfering with human activities or causing damage (Fig. 8).

The first test of our new platform design took place on May 11 2006, in response to a request by the council of the village of Khoronq, in the Armavir region. The local people together with ACE staff moved the nest from a drainage system pipe on to a nest platform on the same roof (Fig. 9).

The success of this effort showed that cooperation between village authorities and wildlife professionals can help solve human-animal conflicts. In 2008, ACE provided 8 nest platforms to the Apaga village, which suffers more than other villages from nests built on roofs.

Discussion

The distribution of White Storks in Armenia is confined to the Araks-Akhuryan river system, which flows mainly along the western border of Armenia. The main population is situated in the Ararat plain, which supports about 30,000 hectares of wetlands (BIODIVERSITY OF ARMENIA 2002). The Akhurian River valley provides a corridor by which storks reach the north-western part of Armenia. There they occupy the area around Lake Arpi, and the wetlands of the Lori plateau. It is not understood why storks do not breed at Lake Sevan in central Armenia, although they stage there on migration. Probably they colonize new breeding sites only gradually, and occupy new areas relatively close to their current breeding sites, in which case Lake Sevan may be too far from the Araks river system. The Hrazdan river (which connects Lake Sevan and the river Araks) has no corridor with appropriate breeding habitats.

The results of our surveys show that in 2005 the number of pairs was much lower than in 1984 (ADAMIAN 1990). This decrease could be caused either by differences in survey methods, resulting in some duplication in the earlier study, or by a real trend, connected with to wetland degradation during the Soviet period (until early 1990s). However, during the period from 2005-2007, the population was increasing. This rise in stork numbers may be the result of an increase in the extent of wetland areas following the break up of the Soviet Union. At that time, ground water pumping stations in the Ararat valley failed and large parts of the previously drained wetland areas were re-wetted. The increase of the White Stork population may be due to this wetland restoration.

Our studies of breeding success show an increase in the number of nests containing 4 fledglings and a decrease in the number of nests with 2 fledglings (Fig. 5). We think that this change in fledgling numbers may be the result of an increase in the available food supply, due to wetland restoration. Differences in the annual productivity and the low value recorded in 2006 (Tab. 2) might be due to nest damage by wind, fire, etc., which was highest in 2006; accordingly, average breeding success was lower in that year due to damaged nests.

Nest damage causes problems for storks and for the Electricity Company. That is why we have proposed building platforms on pylons in order to separate nests safely from the transmission wires. The relocation of nests away from such pylons is worthwhile for the company when viewed over the long-term, and it is beneficial for Storks. It also meets the approval of local inhabitants, who may become strongly disappointed at nest damage or the death of storks.

Potential conflicts between humans and storks that occur when storks build their nests on roofs can be solved if: (1) people do not harm storks by their activities; and (2) appropriate favorable conditions are provided for nesting storks to minimize the damage caused to the people and their activities. Our nest platform programme is one essential step in the optimization of the relationship between humans and storks (ILICHEV 1990). These positive steps will help the restoration of storks to their status as a cultural symbol, and to creating a conservation model based on an ethical and respectful attitude of humans toward nature (BOREJKO & GRISHENKO 2004).

Celebration of White Stork's Day

Much of our work depends on assistance from village volunteers, so-called "nest-neighbors". These people are mainly very enthusiastic about storks and they willingly fill out the data on our calendars. However, there are some nest-neighbors who are less interested, or too busy, or who consider tracking storks to be nonsense. In order to express our gratitude to responsible nest-neighbors, and to inspire others to participate in our "citizen science" programme, in the autumn of 2008 we organized a day of celebration of the White Stork in one village in each of the three *marzes* of Ararat, Armavir and Lori. We prepared useful gifts, such as a coffee cup or summer cap, featuring a picture of a stork. For the village party, we prepared big party cakes with the stork's image on it especially for the village schoolchildren (Fig. 11).

In one of the villages, which has a large number of nests on roofs, we provided nest platforms (following requests from nest-neighbors). The platforms will be placed on the roofs by village administration, with help of nest-neighbors. In another village, we instigated the creation of a White Stork museum in the school, and conducted the opening ceremony together with school and village administrations (Fig. 12). The museum promises to be a further environmental centre in the school, allowing children to realize their creative ideas and participate in study of white storks in their village.

Acknowledgements

We are extremely grateful to:

Whitley Fund for Nature, which supported the project by Whitley Award donated by The Friends of Whitley; Hayk Harutyunyan, Grigor Janoian, Tsovinar Hovhannisyan, Heghine Torosyan, Ruben Malian, Tatevik Tamazyan, for fieldwork support; Meike Schaefer and Tom Lyman for GIS support; Levan Janoian for organizational assistance; Dr. Renee Richer for project formation and fundraising; Aleksey Simonyan for making pole labels; Martin Abelyan and Nelson Grigorian for providing safe transportation; Center of Biodiversity in Yerevan Botanical Garden for the rehabilitation of injured Storks; Ministry of Nature Protection of the Republic of Armenia for support; and also we sincerely thank all the residents of villages in the Ararat, Armavir, Lori, Shirak and Vayots Dzor regions who took part in this study.

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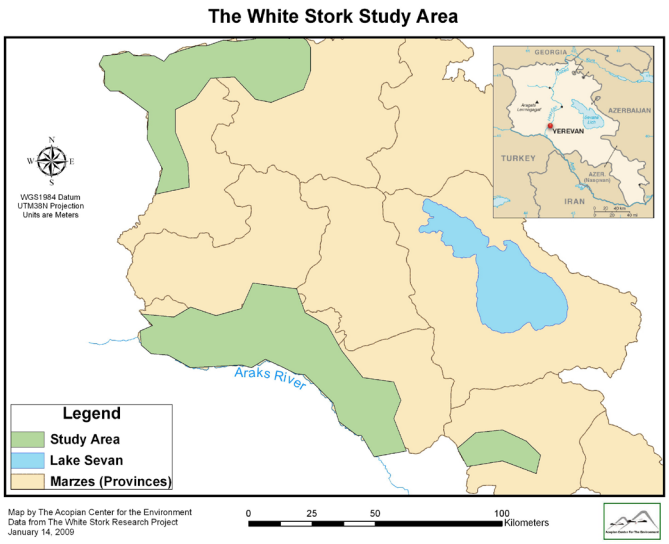

Fig. 1. Study area.

Untersuchungsgebiet.

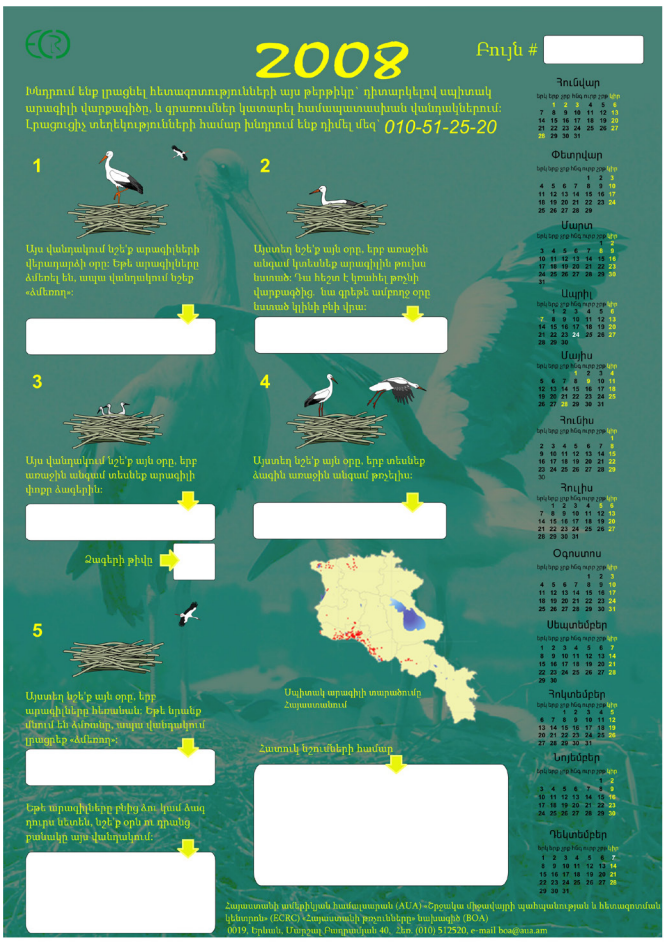

Fig. 2. Wall-calendars distributed to nest-neighbors in 2005-2007 allowed people to record their observations. Special white boxes beneath the explanatory text were filled out by people of various ages.

Wandkalender, die an die Nest-Nachbarn zwischen 2005 und 2007 verteilt wurden ermöglichten die Eintragung ihrer Beobachtungen. Die weiß unterlegten Kästen unterhalb des erklärenden Textes konnten von Beobachtern unterschiedlichen Alters ausgefüllt werden.

Fig. 3. White Stork nest inventory for Vosketap village, Ararat *marz*. Nest identifying numbers are fixed to pylons, building walls, concrete pylons or high-tension electricity pylons.

Weißstorcherfassung im Dorf Vosketap im Ararat marz. Die Identifizierung der Nester erfolgte mit nummerierten Schildern, die an Strommasten und Hauswänden befestigt wurden.

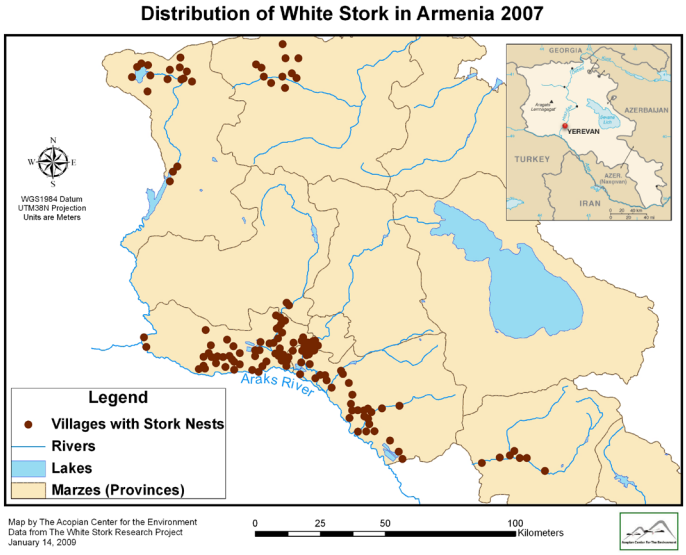

Fig. 4. Distribution of White Storks in Armenia.
Verbreitung des Weißstorchs in Armenien.

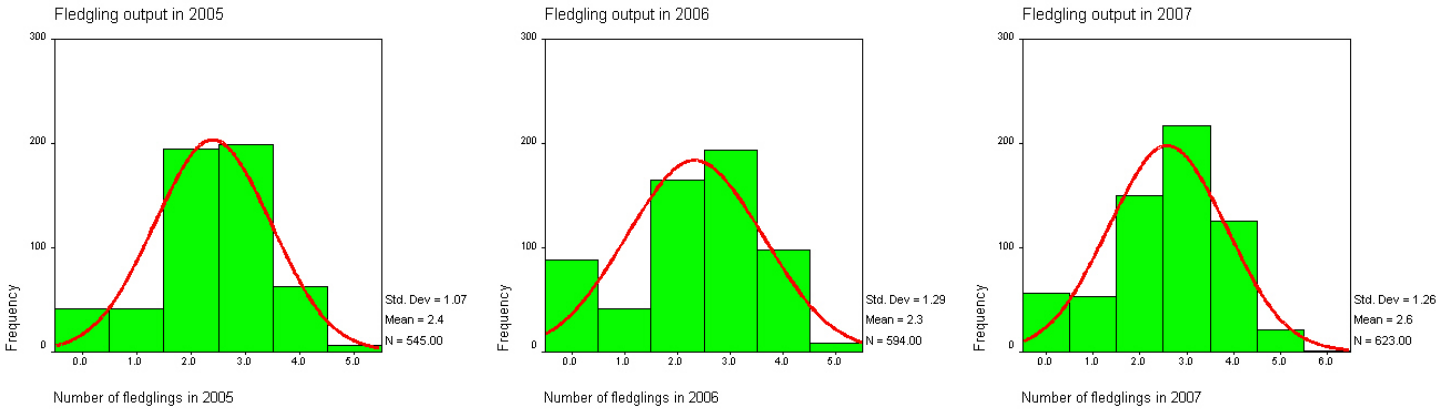

Fig. 5. Numbers of White Storks fledged in Armenia, 2005-2007.
Verteilung der Anzahl von flüggen Jungvögeln in Armenien, 2005-2007.

Fig. 6. White Stork nests on high-tension electricity pylons.
Weißstorchnester auf Hochspannungsmasten.

Fig. 7. White Stork nest on the roof of the school in Apaga village and the corresponding harm caused by it.

Weißstorchnest auf dem Dach der Schule des Dorfes Apaga und der vom Nest verursachte Schaden.

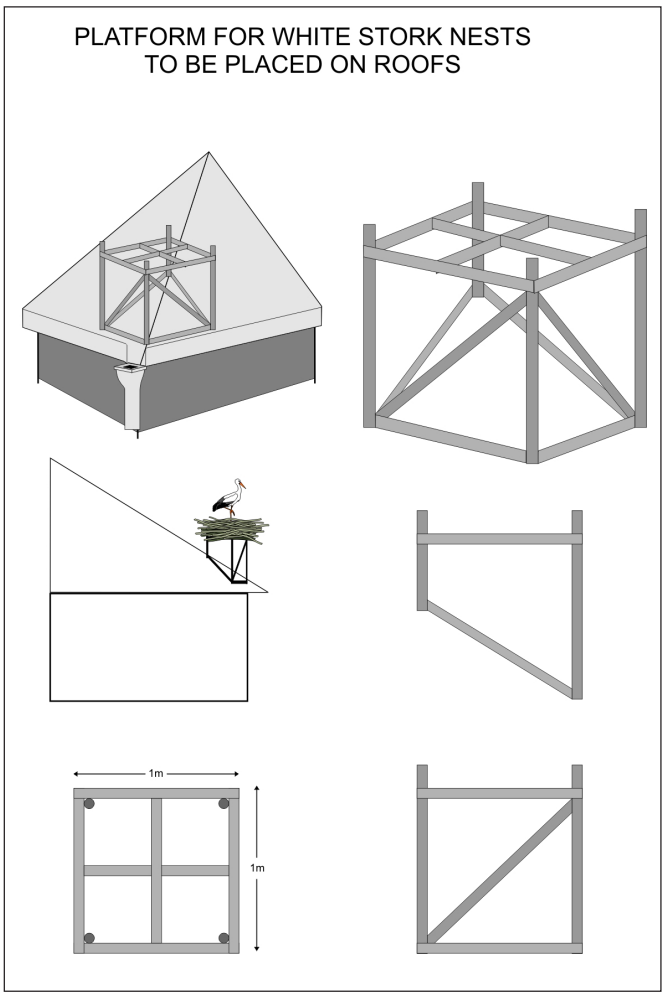

Fig. 8. Artificial platform-support for White Stork nest. In the left upper corner you can see how the platform-support prevents storks from building their nests on drainage system pipes. Dimensions of the platform are as follows: length and width 0.8-1 m depending on the transportation abilities, and height 0.6-0.8 m depending on the slope of the roof. The platform has vertical dowels protruding 20 cm above the flat surface (see two pictures on the right) to give solidity to the nest. These dowels are especially useful when there is a need to move and mount the nest somewhere else.

Nisthilfe für Weißstörche. Links oben: Schutzfunktion der Nestplattform für die Regenrinne. Abmessungen: Länge x Breite = 0.8 – 1 m, abhängig von den Transportmöglichkeiten, Höhe = 0.6 – 0.8 m entsprechend der Dachneigung. Die Nisthilfe besitzt vertikale Zapfen, von 20 cm Länge (sh. Abbildungen rechts). Diese Zapfen sind insbesondere beim Transport und bei der Montage der Nisthilfe nützlich.

Fig. 9. Relocation of a White Stork nest in the Khoronk village of Armavir region. After relocation, the nest is mounted on the artificial platform-support. The adult bird occupied the nest immediately after installation was completed, and during our second visit to the nest showed no sign of alarm. The nest contained two nestlings, which were placed in a separate box and returned to the nest after it had been moved.

Verlegung eines Weißstorchnestes im Dorf Khoronk in der Armavir Region. Nach der Sanierung wurde das Nest auf der Plattform befestigt. Die Altvögel besetzten das Nest sofort nach Abschluss der Arbeiten. Sie zeigten bei einer zweiten Kontrolle keinerlei Scheu. Die beiden Jungvögel im Nest wurden während der Arbeiten in einem Karton untergebracht und danach wieder in das Nest zurückgebracht.

Fig. 10. Celebration of White Stork Day in Novoseltsovo village, Lori region.
Feier eines Storchentages im Dorf Novoseltsovo in der Lori Region.

Fig. 11. Opening Ceremony of White Stork Museum in Surenavan village, Ararat region.
Eröffnungsfeier des Weißstorch-Museums im Dorf Surenavan in der Ararat Region.

Tab. 1. Breeding population of White Stork in Armenia in 1984 and in 2005-2007
Brutbestand des Weißstorchs in Armenien 1984 und 2005-2007.

Region	Number of nests in 1984 (ADAMIAN 1990)	Number of pairs in 2005	Number of pairs in 2006	Number of pairs in 2007
Aragatsotn	0	7	8	10
Ararat	374	235	263	266
Armavir	257	232	241	266
Lori	25	36	41	40
Shirak	4	22	33	26
Vayots Dzor	8	16	15	15
Yerevan	0	0	0	1
Total	668	548	601	624

Tab. 2. Breeding success of White Stork in Armenia in 1984 and in 2005-2007
Bruterfolg des Weißstorchs in Armenien 1984 und 2005 – 2007.

Year	1984 (ADAMIAN 1990)	2005	2006	2007
Average breeding success (number of fledg-lings per occupied nest) JZa	2.55	2.40	2.33	2.59

Tab. 3. Nest locations of White Stork in Armenia in 1984 and in 2005-2007.
Nestunterlagen des Weißstorchs in Armenien 1984 und 2005 – 2007.

In 1984 (ADAMIAN 1990)			In 2005-7		
Nest location	Number	Percent	Nest location	Number	Percent
			Water cistern	8	0.8
			Building tower crane	5	0.5
Roofs of new buildings	142	21.3	Roof	113	11.4
Pylons	335	50.1	Pylon	818	82.4
			Monument	5	0.5
Trees and old constructions	191	28.6	Tree	44	4.4
Total	668	100	Total	993	100

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