Breeding Habitat of the Black Stork *Ciconia nigra* in Lithuania: Implications for Conservation Planning

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Abstract

A significant part of the European Black Stork population breeds in Lithuania. However, the preferences by this species for macrohabitat and microhabitat features have not been analysed statistically until now. In this study, we analyzed field material collected in the last 8 years with the aim of establishing: 1) which habitat characteristics are preferred by the breeding Black Stork at macrohabitat and microhabitat scales and 2) which habitat features should be considered in the planning of Special Protected Areas for the Natura 2000 network aimed at protecting the species and the selection of set aside areas under the sustainable forestry schemes. At the macrohabitat scale Black Stork significantly preferred only dense hydrographical network. Preference for older, productive stands with greater share of broadleaved trees, nesting in forest interior and avoidance of proximity to water bodies and stands with grey alder are the most characteristic features of Black Stork microhabitat in Lithuania. A list of criteria to be used in selection of forest stands potentially suitable for Black Stork nesting was developed.

Key words: *Ciconia nigra*, habitat preferences, habitat use

Introduction

Large vertebrate predators are characterized by large home ranges and select habitat features at multiple spatial scales, from the landscape to micro-level (Sergio *et al*. 2003). Macrohabitat (or home-range, an area used for a long time by individual or pair) and microhabitat (or nest-site, area within home-range used for nesting) are spatial units most used in bird habitat studies (Bosakowski and Speiser 1994, Kostrzewa 1996, Gamauf 2001, Langgemach *et al*. 2001, Tome 2003, Väli *et al*. 2004, Lõhmus 2005, Moran-Lopez *et al*. 2006). Many studies have reported a disproportionate occupancy of avian habitats compared to their average availability (LaHaye and Gutierrez 1999, Suarez *et al*. 2000, Krüger 2002, Ortego 2007). It is important that forest managers understand the essential habitat requirements of species if they aim to develop effective management strategies for reducing or eliminating conflicts between commercial activity and conservation (*e.g*., Lõhmus 2003, 2005, 2006). This issue is relevant to the Black Stork, which inhabits well-forested landscapes of the Baltic States, but where the population has suffered decline over the last two decades (Sellis 2000, Strazds 2005, Treinys *et al*. 2008).

A significant part (~10%) of the European Black Stork population breeds in Lithuania (BirdLife International 2004, Treinys *et al*. 2008). Black Stork is widespread in the country, with approximately 60% (or ~ 39,220 sq. km) of the total area classified as suitable for breeding at landscape scale (Treinys *et al*. 2008). Previous data on its nest stands and nest-trees in Lithuania have been mainly descriptive (Drobelis 1993, Drobelis *et al*. 1996, Skuja and Budrys 1999), and we recently have found some evidence of simultaneous habitat degradation and adaptation processes in the population (Treinys *et al*. 2008). Thus use of outdated information could lead to erroneous conservation decisions. At present Lithuania has designated 6 large Special Protected Areas under the European Birds Directive (*Valstybės Žinios* 2006 08 29 Nr. 92-3635). Their management planning, based on most recent research, could improve significantly the protection of the species within the country. Furthermore the FSC

(Forest Stewardship Council) Generic Forest Management Standard used for forest certification in Lithuania includes criterion 6.2, which commits forest managers to protect rare, threatened and endangered species and their habitats and to establish conservation zones. Therefore at least part of set aside forest areas (a minimum 5% of a forest management unit, as stated in the indicator, SmartWood Interim Standard for Lithuania 2008) could be selected on the basis of the ecological requirements of the Black Stork.

In this study we analyze recently collected comprehensive field material with the aim to establish: 1) what habitat characteristics are preferred or avoided by the breeding Black Stork at macrohabitat and microhabitat spatial scales and 2) what habitat features should be considered in the planning of Special Protected Areas for Natura 2000 network and the selection of set aside areas according to FSC. We expect weak habitat selectivity, because of the large population size and the wide species distribution in the country. A negative relationship exists between population size and selectivity: when population size is large, selectivity is low and *vice versa* (Lõhmus 2001).

Materials and methods

To assess habitat use we measured 4 macrohabitat and 13 microhabitat characteristics around 90 nests (each in a distinct breeding territory), occupied by Black Storks at least once during 2000-2007. A nest was assessed to be occupied if it contained eggs or nestlings (or their remains), or if it had been repaired by a non-breeding pair or a single bird in spring.

Macrohabitat analysis

We defined macrohabitat as a circular plot of 2.8 km radius, which is close to half of the average distance between neighbouring nests (author's observations) and similar to the distances used previously for the species (Lõhmus *et al*. 2005, Treinys *et al.* 2008). Using digital maps (1:50000), we measured share of 1) forest cover, 2) built-up areas (towns, settlements, farmsteads), 3) hydrographical network density (length of rivers, drainage ditches + perimeter of water bodies; km per sq. km) and 4) infrastructure (roads, railways) network density (km per sq. km). For detecting preferences, we followed the methods described in similar bird habitat studies (Väli *et al*. 2004, Lõhmus *et al.* 2005). Above mentioned variables similarly were measured around 90 random forest points, distributed among administrative districts according to the number on nests. Measured variables were strongly intercorrelated and we used principal component analysis based on correlations to find independent combinations (Appendix). For factors extraction, only random points' data were used (in the breeding territories, some intrinsically uncorrelated characteristics may cooccur due to the preferences of birds). Components with an Eigen value greater than 1.0 were accepted for further analysis, and their factors scores were calculated for both random points and breeding territories. The first macrohabitat component ("undisturbed forest") explained 48% of total variation and distinguished between well forested landscapes with low anthropogenic load (low scores) and scarcely forested landscapes with high share of build-up areas and well developed infrastructure (high scores). Second principal component explained 26% of total variation and was primarily correlated with the hydrographical network density (Appendix). Considering also the interpretation easy we retained original variable -density of hydrographical network - instead the second principal component for further analysis. Distributions of variables were checked for normality (Kolmogorov-Smirnov test). Density of hydrographical and infrastructure networks were square-root-transformed and proportions arcsine-square-root transformed prior to analysis. To demonstrate habitat preferences, we used parametric *t*-test to check whether means of stork macrohabitats differ from those in random plots.

Microhabitat analysis

In order to describe availability in Black Stork macrohabitats, we generated 90 random forest points, one within 2.8 km radius of each described nest. Using the Forest Inventory Data Base of the State Forest Survey Service, we described the following characteristics in forest stands at the nest sites and random forest points: 1) age of the stand, 2) dominant tree species, 3) relative basal area (scale 0.1…1), 4) forest type, 5) humidity (5 classes and 4 scores, 1 …4 , larger score indicates higher soil humidity), 6) site quality class (at a scale IA, I…V; larger score indicates worse conditions of tree growth (for detailed description see Repšys 1994) and 6 scores as well, 0 - IA….5 -V), and the share of 7) conifers, 8) broadleaves and 9) other deciduous tree species in the stand. We also measured the distance from nest-tree or random point to the nearest 10) forest edge (*i.e.*, to fields, bogs, lakes >1 ha, but not to clear fellings), 11) infrastructure element (road or railway), 12) built-up area (farmstead or settlement), 13) hydrographical element (stream, ditch or lake). Measured distances were strongly intercorrelated therefore we used principal component analysis as were described above. The first microhabitat component ("forest interior"; 38% of total variation, see Appendix) distinguished between stands in forest interior far from constant sources of disturbance (low scores) and stands near forest edges close to constant sources of disturbance (high scores). The second and third principal component explained 26% and 25% of total variation, respectively. The second component was primarily correlated with the distance up to road and third component – with the distance up to hydrographical element (Appendix), thus considering also the interpretation easy we retained these original variables instead of two principal components for further analysis. Distributions of all variables were checked for normality (Kolmogorov-Smirnov test) and were log-transformed prior to analysis. The preferences of the Black Stork for the microhabitat characteristics were tested by comparing samples with the Mann-Whitney U test or *t*-test depending on the normality of distribution (Kolmogorov-Smirnov test). The frequency distributions were compared with a chi-square test.

Appendix. Correlation coefficients of the measured macrohabitat and microhabitat variables with the principal components in random plots

Macrohabitat variable	Principal components 1	2
Infrastructure network density	0.65	-0.26
Hydrographical network density	0.26	-0.92
Built-up areas share	0.87	0.29
Forest share	-0.81	-0.18
Explained variation %	47.6	25.6
Cumulative variation %	47.6	73.2

Microhabitat variable	1	2	3
Distance to nearest:			
house	-0.87	-0.11	-0.16
road or railway	0.00	-0.95	-0.29
forest edge	-0.88	0.12	0.12
water body	-0.04	-0.33	0.94
Explained variation %	38.3	25.7	25.2
Cumulative variation %	38.3	64.0	89.2

Results

Descriptive statistics of the analysed variables are presented in Tables 1–3.

At the macrohabitat scale Black Stork did not prefer undisturbed forest (t_{178} = - 0.95, *P* = 0.34), but significantly preferred well developed hydrographical network (t_{178} = - 3.81, *P* = 0.0002) comparing to the availability in the landscape. At the microhabitat scale the Black Stork preferred stands in forest interior (t_{174} = 2.959, *P* = 0.004), but avoided proximity to water bodies (t_{174} = - 2.01, *P* = 0.046). However, we found no differences in distances between nest-tree and random points to the nearest infrastructure element (t_{174} = - 0.45, *P* = 0.65). Altogether 69% (n = 90) of Black Stork nests and 63% (n = 86) of random points were in the stands of 4 forest types, which were used according to their availability within the macrohabitat (χ^2_4 = 1.76, *P* = 0.78). According to humidity, the stands were used proportionally to their availability within the macrohabitat: 2.01 ± 0.88 (SD) and 1.86 ± 0.88 (SD) for Black Stork and random stands respectively (U = 3523, *P* = 0.30). Black Stork preferred stands of higher site quality class (more productive stands): 1.29 ± 1.03 (SD) and 1.63 ± 1.01 (SD) for Black Stork and random stands respectively (U = 3200, *P* = 0.047). The nest stands of

Table 1. Descriptive statistics (mean, median, minimum, maximum, 25% and 75% quartiles, standard deviation) of forest cover, built-up areas share, hydrographical network (km/1sq.km) and infrastructure network density (km/1sq.km) in the macrohabitat of Black Stork (n = 90) and in the random plots (n = 90)

Variable		Mean	Median	Min	Max	25% qr	75% qr	SD
Forest cover, share	BS	0.490	0.450	0.137	1.000	0.335	0.608	0.217
	RP	0.483	0.417	0.072	1.000	0.311	0.672	0.228
Built-up areas, share	BS	0.020	0.018	0.000	0.131	0.010	0.029	0.017
	RP	0.029	0.023	0.000	0.138	0.011	0.040	0.026
Hydrographical network density (km/sq.km)	BS	1.410	1.257	0.243	4.452	0.807	1.695	0.863
	RP	1.007	0.884	0.000	4.601	0.531	1.398	0.668
Infrastructure network density (km/sq.km)	BS	0.796	0.773	0.333	1.687	0.579	0.996	0.275
	RP	0.819	0.825	0.242	1.535	0.614	0.997	0.282

Table 2. Dominant tree species, forest type, humidity and site quality class in Black Stork (n = 90) nest stands and in the random (n = 86) stands

Stand variable		Black Stork	Random point
Dominant tree species	Pine	8%	17%
	Spruce	26%	21%
	Birch	26%	20%
	Aspen	9 %	7%
	Black alder	11%	10%
	Grey alder	0%	13%
	Oak	10%	6%
	Ash	8%	6%
	Lime	3%	0%
Forest type	*Aegopodiosa*	23%	23%
	Hepatico-oxalidosa	16%	15%
	Myrtillo-oxalidosa	19%	15%
	Oxalidosa	11%	10%
Humidity	Slopes	1%	2%
	Normal	26%	31%
	Temporarily soaked	57%	53%
	Peatland	6%	6%
	Waterlogged	11%	7%
Site quality class	IA	30%	16%
	I	23%	23%
	II	35%	45%
	III-V	12%	16%

Table 3. Descriptive statistics (mean, median, minimum, maximum, 25% and 75% quartile, standard deviation) of the distance from Black Stork nests (n = 90) and random points (for distance n = 90, for stand variables n = 86) to nearest landscape elements (forest edge, infrastructure, hydrographical elements, built-up areas). Also descriptive statistics of stand age (years), relative basal area, share within stands of pine, spruce, birch, aspen, grey alder, black alder, oak, ash, lime, conifers, broadleaves, other deciduous trees species

Variable		Mean	Median	Min	Max	25% Qr	75% Qr	SD
Forest edge (m)	BS	494	353	29	2787	193	619	466
	RP	388	258	1	2478	51	512	466
Infrastructure element (m)	BS	568	472	73	1439	279	796	361
	RP	556	538	20	1792	237	767	381
Hydrographical element (m)	BS	486	362	10	1988	225	708	382
	RP	424	293	8	2675	121	530	454
Built-up areas (m)	BS	929	751	159	3979	529	1061	655
	RP	816	643	138	3961	387	1013	621
Stand age (year)	BS	81	75	40	155	65	90	25
	RP	56	55	2	135	35	70	31
Relative basal area	BS	0.69	0.70	0.50	1.00	0.60	0.80	0.13
	RP	0.73	0.70	0.30	1.00	0.70	0.80	0.16
Pine share	BS	0.05	0.00	0.00	0.90	0.00	0.00	0.18
	RP	0.14	0.00	0.00	1.00	0.00	0.00	0.30
Spruce share	BS	0.21	0.10	0.00	1.00	0.00	0.30	0.25
	RP	0.23	0.10	0.00	1.00	0.00	0.30	0.31
Birch share	BS	0.24	0.20	0.00	1.00	0.10	0.40	0.23
	RP	0.21	0.10	0.00	1.00	0.00	0.30	0.24
Aspen share	BS	0.14	0.10	0.00	0.80	0.00	0.20	0.18
	RP	0.08	0.00	0.00	0.70	0.00	0.10	0.16
Black alder share	BS	0.13	0.00	0.00	1.00	0.00	0.20	0.23
	RP	0.09	0.00	0.00	1.00	0.00	0.10	0.20
Grey alder share	BS	0.01	0.00	0.00	0.30	0.00	0.00	0.04
	RP	0.12	0.00	0.00	1.00	0.00	0.00	0.27
Oak share	BS	0.10	0.00	0.00	0.70	0.00	0.10	0.18
	RP	0.06	0.00	0.00	0.90	0.00	0.00	0.16
Ash share	BS	0.07	0.00	0.00	0.70	0.00	0.10	0.14
	RP	0.05	0.00	0.00	1.00	0.00	0.00	0.14
Lime share	BS	0.03	0.00	0.00	0.70	0.00	0.00	0.11

Black Stork were significantly older than the random stands (t_{174} = 5.99, P < 0.0001). Relative basal area did not differ significantly between the nest and the random stands, however, Black Stork tended to use less dense stands (t_{174} = 1.72, P = 0.09).

Dominant tree species composition of the Black Stork nest stands significantly differed from random stands (χ^2_8 = 23.55, P = 0.003). Black Stork preferred stands with greater share of broadleaved trees (U = 3019, P = 0.01), but the share of other deciduous trees species (U = 3763, P = 0.32) and conifers (U = 3402, P = 0.17) in the nest-stands did not significantly differ from the random stands. The nest stand tree species composition analysis indicated preferences for oak (U = 3094, P = 0.02) and aspen (U = 2770, P = 0.001), but avoidance of grey alder (U = 3175, P = 0.04). The share of lime (U = 3827, P = 0.90), birch (U = 3421, P = 0.18), black alder (U = 3369, P = 0.14), ash (U = 3512, P = 0.29), spruce (U = 3754, P = 0.35) and pine (U = 3527, P = 0.31) did not differ from the share of these tree species in the random stands.

Discussion and conclusions

We found few significant habitat preferences of the Black Stork at both spatial scales, as expected from its large and widespread population in the country.

The results have not confirmed presence of significant preference of the Black Stork for well-forested environment with the low anthropogenic disturbance in Lithuania. Preference of breeding Black Storks for high forest cover has been found in Estonia (Lõhmus *et al.* 2005). However, in Lithuania, Black Storks breed in significantly less forested landscape than in Estonia (49% ± 22% (SD) *vs.* 74% ± 16% (SD)). The Black Stork is at the north-western border of its distribution range in Estonia (Sellis 2000). Consequently birds could be more selective for their typical habitat - well forested landscape – to compensate for the generally less suitable environmental conditions (which presumably cause the distribution border) and where, according to sequential habitat occupation, birds could occupy only the best sites (see references in Väli *et al.* 2004). On the other hand, difference in forest share between Black Stork nesting habitats in Lithuania and Estonia could be only a consequence of distinct land use history (for similar results and opinion see Väli *et al.* 2004).

Black Stork significantly preferred sites with high hydrographical network density. This finding is not unexpected as water bodies and streams are essential feeding places for this species (Angelstam *et al.* 2004, Jiguet and Villarubias 2004). Moreover, the analysis of the Black Stork prey sample collected in nests during 2000-2007 confirms significance of water bodies for feeding in Lithuania: fish made up 58% and amphibians 41% of the sample (n = 160) (D.Stončius and R.Treinys, unpubl.).

Black Stork could be regarded as typical forest interior species, at least in Baltic States. Black Stork preferred stands in forest interior both in Lithuania (Droblelis 1993, this study) and in Estonia (Lõhmus *et al*. 2005). Preference to forest interior could be an advantage in terms of feeding habitat and enables to escape from disturbance: the distance from Black Stork nest-trees to forest edge was strongly positively correlated with the density of hydrographical network (r = 0.41, P = 0.0001, n = 90) as well with the distance to nearest farmstead / settlement (Appendix). However, we did not find evidence that breeding deep in the forest could be related with better possibilities to find strongly preferred older stands: nest stand age was not related with the distance to the forest edge (r = - 0.05, P = 0.65, n = 90). On the contrary, it seems that breeding closer to the forest edge could be advantageous in terms of nest-tree selection. Since oak is the main (76%, Treinys *et al*. 2008) as well as the preferred nest-tree and there were more oaks near forest edge (the distance from nest-tree to forest edge was nearly significantly negatively related to the share of oak within the nest stand, r_s = -0.18, P = 0.09, n = 90), breeding closer to forest edge could increase the probability of finding suitable nest-trees (Treinys *et al*. 2008), which could otherwise limit the population (*e.g*. only 0.3% of forests are suitable for Black Stork nesting in Estonia; Lõhmus and Sellis 2003).

At microhabitat level the Black Stork avoided stands near water bodies and this pattern was opposite to the situation at macrohabitat scale. However, roads were not avoided. Our finding contrasts with the results from Estonia where breeding storks prefer remote stands near rivers (Lõhmus *et al.* 2005). Densities of hydrographical and infrastructure networks significantly correlated in the Black Stork territories (r = 0.36, n = 90, P = 0.0004). Such positive relationship between two ecologically contrasting features (similar relationship was found in *Aquila pomarina* habitat; Väli *et al.* 2004) suggests that species could face a trade-off situation between demands for typical feeding places and less disturbed nest-sites. Food search over large areas and long feeding flights (data on home-range size, Janssen *et al.* 2004, Jiguet and Villarubias 2004, Renno Nellis, pers. comm.) could be the costs storks pay for nesting in less disturbed areas.

Preference for older, productive, sparse stands with more oak and aspen trees and avoidance of grey alder are the most characteristic features of Black Stork nest stands in Lithuania. We found the mean age of nest stands to be 81 years, which is close to that in the other Baltic States (~ 75-105 years, Lõhmus and Sellis 2003). The general preference for nesting in old forests is the typical feature of Black Stork in Central and Eastern Europe (Drobelis 1993, Drobelis *et al*. 1996, Sackl and Strazds 1997, Skuja and Budrys 1999, Lõhmus and Sellis 2003, Kaloksa and Tamas 2006). However, the species breeding success was not related to the preference for old-growth forests and this preference itself could be simply related to the presence of potential nest-trees in even-aged forests (Lõhmus *et al*. 2005). Preference for productive stands could be related with presence of larger trees than available in poor stands. Trees growing on fertile soil could reach sufficient size suitable for nest building more quickly than trees on poor soil, moreover, nest-tree size is the more important feature than tree age *per se* (Lõhmus 2006). Preference for stands with greater share of oak and aspen reflect the significance of these tree species for nest building: in Baltic States 54% (n = 812) of Black Storks nests were built in oak and aspen (Lõhmus and Sellis 2003, Starzds 2005, Treinys *et al.* 2008), whereas they cover only ~ 3.2% of the region forest landscape (*Lietuvos miškų statistika* 1998). Low share of grey alder in the Black Stork stands could be the consequence of preference to forest interior, as the share of grey alder in the random stands were negatively related with the distance to forest edge (r_s = -0.34, P = 0.002, n = 86). Nesting in stands with sparsely growing trees recorded previously too (Drobelis *et al*. 1996) supposing related with better flying conditions for large birds.

Finally, our results indicated that the weak disproportional use of the stand variables found in this study could be explained by two mutually non-exclusive reasons: 1) general suitability of the forests in Lithuania for Black Stork nesting and 2) nest-tree being as the key factor for the stand selection. First, Black Stork stand characteristics differed only slightly from the random pattern. The second suggestion could be supported by the following facts: 1) 25% of our analyzed nests were in 40-65 year-old stands, which are not suitable for the species without good nest-trees (author's observation), 2) in the Baltic States mean nest-tree age is 24-77 years greater than the mean age of the surrounding stand (Lõhmus and Sellis 2003) and 3) in Lithuania, the nest stand age has recently decreased and nest-tree age increased without any effect on breeding success (Treinys *et al*. 2008).

The results of this study, as well as published and unpublished data of our previous research, were used for developing criteria (see Table 4), that could be applied to detect potential nesting patches for Black Stork in planning of Special Protected Areas and set aside areas according to the requirements of FSC. The criteria could be applied in forests which are outside areas with high levels of anthropogenic disturbance. Moreover, we would like to emphasise, that the final decision on suitability of particular stand for Black Stork conservation should be made only after field verification. Set aside forest areas should not only meet forest stand and „right place on landscape" criteria, but should also contain appropriate nest-trees.

Table 4. The list of criteria to be used for the selection of forests stands appropriate for Black Stork breeding

Variable	Recommended traits/values
Distance from the:	
Infrastructure element (marked in map 1:50 000)	> 280 m
Farmstead / settlement	> 530 m
Forest edge	> 200 m
Dominant tree species in the stand	Grey alder dominated stands should be omitted. Pine dominated stands could be accepted, if the stands that are dominated by spruce, birch, oak, black alder, or ash are scarce within forest
Forest type	*Aegopodiosa, Hepatico -oxalidosa, Myrtillo-oxalidosa, Oxalidosa*
Humidity	Normal or temporarily soaked
Site quality class	Preferably IA, as well I, II
Relative basal area	0.6 - 0.8
% of broadleaves	~ 10-20%, mostly oak. Could be ash in forests where oak is scarce
% of aspen	~ 10-20% , especially in forests lacking broadleaved trees
Stand age	> 65 years
Potential nest-tree	Trees having strong horizontal branches at 10-14 m or fork in the main trunk at 12-15 m height from the ground Trees should be large: diameter at 1.3 m height for oak > 72 cm, pine > 39 cm, ash > 73 cm, aspen > 62 cm, birch > 46 cm

We assume that the currently still-numerous Lithuanian Black Stork population might, in future, be limited by the development of urban areas and infrastructure. Maintenance of remote, mature, productive stands with the presence of large, mainly oak, trees will be the main task for conservation of forests suitable for Black Stork nesting. Green tree retention and saving previous generation trees in young and middle aged stands during various selective cutting operations will help to reach this goal. On the other hand, this tool is favourable for conservation of many other taxa and widespread application of green tree retention over large forested areas under national legislation or voluntary commitment (*e.g.*, under FSC scheme) could significantly improve future prospects of the Black Stork nest-sites without special attention for this species.

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МЕСТООБИТАНИЯ ЧЁРНОГО АИСТА *CICONIA NIGRA* В ЛИТВЕ: ПРЕДЛОЖЕНИЯ ДЛЯ ПЛАНИРОВАНИЯ ОХРАНЫ

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Резюме

В Литве гнездится значительная часть Европейской популяции чёрного аиста. Однако предпочтения свойств макроучастков и микроучастков этим видом до сих пор не было статистически анализированно. В данной статье нами проанализирован полевой материал, собранный за последние 8 лет с целью установить: 1) каким характеристикам места обитания чёрный аист отдаёт предпочтение на уровнях гнездового макроучастка и микроучастка а также 2) какие свойства места обитания должны быть включены во планирование специальных охраняемых территорий сети Натура 2000 с целью охраны вида и при отборе нетронутых территорий, оставляемых по схемам экологического лесоводства. На уровне гнездового макроучастка чёрный аист отдаёт значительное предпочтение только частой гидрографической сети. Предпочтение более зрелых, продуктивных древостоев с значительным составом твердолиственных деревьев, гнездование в глубине леса и избегание близости водоёмов и древостоев с серой ольхой - это самые характерные свойства гнездового микроучастка чёрного аиста в Литве. Нами был выявлен ряд критерий, которые могут быть использованны при отборе древостоев, потенциально пригодных для гнездования чёрного аиста.

Ключевые слова: *Ciconia nigra*, предпочтения места обитания, пользование места обитания