



PRELIMINARY BIRD FAUNA'S MONITORING IN THE FUTURE WIND FARM IVESTI – VASLUI COUNTY (ROMANIA)

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SYNOPSIS

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We present our results obtained during one year monitoring of the bird fauna in the area Ivesti – Vaslui County, where one large wind farm will be build. We focused our attention on the birds' diversity and effectives, following the daily movements, the hunting and feeding territories during all the phenological aspects, the existence of migration flyways in the area, but also the habitats' structure and anthropogenic activities' influence their evolution. We gave special attention to the group of soaring birds, especially, raptors, following their presence and mapping their hunting territories during the wintering and breeding periods. We paid our efforts, also, to the 15 bird species included in the Annex 1 of the Birds' Directive like Key-species to assess the impact of the development of one wind farm in the area, following their status and effectives in the investigated area.

INTRODUCTION

In the present conditions of the fossils natural resources (coal, oil, natural gas) obviously diminution and the more intensive concerns regarding the diminution of carbon dioxide emissions in the context of the climate global changing, during the last decades and especially, in the last years, there on created new energetic national strategies and were intensified the research on the energetic production using the renewable, non-pollutant, resources like wind energy, sun energy, biogas, etc.

At the beginning of this new energetic sector's development, the national laws regarded just the technical aspects. During the last years, everywhere in the world,

there were intensified monitoring studies focused on the birds and bats populations, using these flying vertebrates in order to assess the impact of wind farms' development on the habitats and biodiversity's dynamic. The standardization of one monitoring methodology follows to obtain comparable data in different study areas, but also to elaborate monitoring rules, enough flexible to adapt it in a specific investigated area and for specific technical parameters of the future wind farm (HÖTKER, 2006).

The initial starting point for the impact studies of the wind farms is represented by the protocol BACI (Before/After Control Impact), done in the middle '90 years in the last century, in U.S.A., that follows the conservation status of the birds and bats populations before and after the settlement of one wind farm (RISSE et al., 2007). The standard methodology take like basis point a monitoring study of the birds and bats populations done in two stages, each about minimum 12 months before and after the wind farm' settlement. The specialists assess that this kind of impact study can offer enough and relevant data to evaluate the collision risk and other threatening factors for these two vertebrates groups.

During the first working stage, the monitoring study follows nor only to establish the birds and bats populations' diversity and to estimate the effectiveness of each species in the investigated site (including the perimeter and the neighbourhoods of the future wind farm) but also different aspects of these species' biology and ecology: identification of the feeding, mating/breeding, resting and sheltering territories, identification of some migration flyways, the existence of breeding colonies and wintering sites, establishing the daily movements of birds and bats.

During the second work stage, it is possible to evaluate the directly impact on the birds and bats populations (mortality rate due the collision with the wind farms' elements), but also the indirectly impact (modifying of the daily movements and of the migration flyways, abandonment of the mating/breeding, feeding, resting/sheltering and wintering territories, modifying the sex and age structures, but also of the density for some species population).

The Romanian Ornithological Society (SOR/BirdLife Romania) encourages the wind farms' development with the condition to preserve some technical aspects in order to permit:

- creating a minimum impact on the region's biodiversity;
- the preservation of the territories with high importance for birds (Important Birds' Areas/IBA), of the Nature 2000 Network sites (Special Protected Areas/SPA and Sites of Community Importance/SCI), of the natural parks and wetlands of international importance for the biodiversity's conservation (RAMSAR sites, Biosphere's reserves - UNESCO);
- avoiding the principal flyways for birds (and bats)' migration;

- identifying technical solutions to reduce the collision risk to the lowest level for the birds (and bats).

PERIOD AND STUDY METHODS

During the period November 2008 - 31 October 2009, we done a regularly monitoring focused on the birds and bats populations present during the all yearly phenological aspects, inside and in the neighbourhood of the area Ivesti – Pogonesti – Coroiesti - Ciocani (Vaslui County), where will be develop a wind farm. We must notice that there is not any available previous study on the birds and bats' presence in the area or on the habitats from this territory.

We identified the bird species and we estimated their effectives using the direct observation through the binoculars and telescope, through the visual recording and through the males' sounds, too. We followed to identify and estimate the wintering birds' population, but also the diversity and the effectives present during the migration time and breeding period inside and in the neighbourhood of the future wind farm's area. The forest and open sites birds were counted along transects and from fixed observation points, too.

During the period May - June, we had done nocturnal monitoring too, visiting the site twice in May and June, in order to identify the presence and the effectives of the Corncrake (*Crex crex*) and the nocturnal raptors in the investigated area. During the migration time, in order to identify the bird species and to evaluate their effectives, we used the transect and fixed point counting methods, the second one being very useful for the monitoring of soaring birds (raptor birds - Accipitridae, Pandionidae and Falconidae, respectively, storks - Ciconiidae). These methods permit, also, to identify the existence of the flyways inside or nearest the site's perimeter and to establish the limits of the hunting or feeding territories used by the birds in the visited area. During our fieldwork, we followed mapping the birds' flyways, hunting and feeding territories (especially, for the raptor birds group), the local movements ways of different bird groups between the breeding areas and feeding territories. We focused our attention on the birds' flights' height during their movements inside the perimeters of the future wind farms, too.

During the winter period, taking benefits from the better visibility due the absence of the leaves, we tried to identify the number and the position of the large nests that could be occupied by the raptor birds or by the Raven (*Corvus corax*) in the forest areas along our observation transects and their vicinity.

We must notice that in the Vaslui County's area there is just one previous study on the bird's fauna, without any information on the present investigated perimeter (PAPADOPOL, 1975).

RESULTS AND DISCUSSIONS

We must notice that in the south-eastern part, the future wind farm's perimeter is situated closed to Badeana Forest, protected area and part of the Romanian Nature 2000 Network like site of Special Conservation Interest - SCI (ROSCI 0133 in the OMM no. 1964/2007). In the south-western neighbourhood of this wind farm, too, there exists a dam lake – Piscu Morii accumulation, on the Pereschev rivulet's valley. The monitoring of the birds' fauna in this perimeter permitted to evaluate the diversity of aquatic and semi-aquatic birds that are resting, feeding and breeding in the wetland habitats, following the movements of these bird species to search food or resting sites inside and nearest the future wind farm area.

The principal ecosystems and habitats in inside and in the neighbourhood of this site are:

- the arable lands (during the winter, we recorded the presence of large surfaces covered by rape and smaller territories cultivated with winter wheat cultivated areas; the principal cultures in this site are: rape, wheat, barley, sunflower, maize and alfalfa),

- the forest ecosystems (the most important are Balaurului Forest, in northern part of the site, nearest Ciocani village and Badeana Forest, in south-eastern part, but there exist some small and young woodland plantations, too – the greatest of its are situated in the vicinity of Ivesti and Pogonesti villages),

- abandoned arable lands, covering small surfaces in some areas of the site,

- the dry meadows, with small herbs and some bushes plots,

- the wet meadows, in the ending part of Piscu Morii Lake,

- the open aquatic surface, with some compact reed beds in the north and north-western banks – Piscu Morii Lake; along the Pereschev rivulet's valley, in the north from the dam lake, there exist a flooding meadow forest.

As we saw during our fieldworks, in forestlands, the deforestation risk is low, especially in the larger ones. Maybe is not useless to notice the fact that for the Badeana Forest's vicinity with the future wind farm's perimeter, there exist a large buffer area (an enough large acacia plantation – *Robinia sp.*, that, like a rule, present a low level of biodiversity).

The local communities use the most part of the dry meadows like grazing territories.

The wet meadows and the reed beds' perimeter could represent suitable breeding habitats for some aquatic birds and waders; we not observed special or high disturbing activities in this area. In the flooding meadow forest from the Pereschev rivulet's valley, we observed vegetal material (osier, brushwood) extraction activities for wickerwork with different using, but for domestic fires, too.

The 2008's winter presented a low level of rainfalls and snowing, associated with low temperatures. The 2009's March month presented a very freaky weather

regime: the temperatures recorded a large variance from one decade to other; by other hand, the rainfalls had a high level and prolonged time; in these conditions, the access was very difficult inside the investigated area.

After this, beginning from the second decade of the April month, the weather became stable and evaluated to a dryness stage, unfortunately characteristic for the central and southern part of Moldova (historical region in the eastern part of Romania), including the whole territory of Vaslui County. During the June and July months, the weather conditions kept the excessive and oscillated character, recording a successive alternation of the dryness periods associated with very high temperatures (bigger than 35 °C) and a high instability weather condition times associated with strong winds and torrential rainfalls.

During the second middle part of summer, the dryness became definitely, so, in September, we recorded the harvesting of the majority crops, while the wild vegetation was dried, ending the vegetative stage of this year. In the late September, the people began the autumn ploughing and sowing works in this site, so, in the last part of October, after one period with high rainfalls' level (the second decade of October), the rape and winter wheat were germinated, greening the lands.

We notice that we do not present in this study our results regarding the monitoring of bird fauna from the Pereschev rivulet valley and Piscu Morii Lake; as we saw, these birds are not visiting the perimeter of the future wind farm.

The birds' diversity is not so big in the investigated area – table 1; on the future wind farm's perimeter, agricultural lands and dry meadows cover large surfaces, while the woodlands are present just in the vicinity.

Table 1 - Birds' diversity and presence in the area Ivesti – Pogonesti – Coroiesti - Ciocani (Vaslui County), 2008 – 2009.

Legend: S – sedentary species; PM – partial migratory species; SV – summer visitor; P – passage species; WV – winter visitor, RW - rare winter visitor.

No.	Species name	Presences and effectives				Phenology in Romania	Birds' Directive (Annex 1)
		Wintering (Individuals)	Migration (Individuals)	Breeding time			
				Pairs	Individuals		
1.	<i>Ciconia ciconia</i>	-	3	-	-	SV	+
2.	<i>Hieraaetus pennatus</i>	-	2	-	-	SV	+
3.	<i>Aquila heliaca</i>	1	-	-	-	PM	+
4.	<i>Buteo buteo</i>	12	10	1	4	PM	-
5.	<i>Buteo lagopus</i>	3	-	-	-	WV	-
6.	<i>Pernis apivorus</i>	-	4	-	-	SV	+
7.	<i>Accipiter gentilis</i>	-	9	1	4	S	-
8.	<i>Falco subbuteo</i>	-	6	2	7	SV	-
9.	<i>Falco columbarius</i>	5	-	-	-	WV	+

10.	<i>Falco peregrinus</i>	4	-	-	-	S, WV	+
11.	<i>Perdix perdix</i>	18	67	12	60	S	-
12.	<i>Phasianus colchicus</i>	44	-	8	56	S	-
13.	<i>Coturnix coturnix</i>	-	91	9	72	SV	-
14.	<i>Columba palumbus</i>	-	59	10	40	SV, RW	-
15.	<i>Streptopelia turtur</i>	-	67	12	48	SV	-
16.	<i>Streptopelia decaocto</i>	70	-	30	135	S	-
17.	<i>Cuculus canorus</i>	-	57	15	75	SV	-
18.	<i>Athene noctua</i>	13	22	7	24	S	-
19.	<i>Bubo bubo</i>	5	-	2	7	S	+
20.	<i>Asio otus</i>	24	48	5	20	S	-
21.	<i>Apus apus</i>	-	78	10	50	SV	-
22.	<i>Merops apiaster</i>	-	29	-	-	SV	-
23.	<i>Upupa epops</i>	-	82	11	66	SV	-
24.	<i>Picus viridis</i>	17	-	7	28	S	-
25.	<i>Picus canus</i>	10	-	3	10	S	+
26.	<i>Dendrocopos major</i>	17	-	12	46	S	-
27.	<i>Dendrocopos syriacus</i>	62	-	18	77	S	+
28.	<i>Dendrocopos medius</i>	10	-	5	18	S	+
29.	<i>Jynx torquilla</i>	-	26	6	21	SV	-
30.	<i>Galerida cristata</i>	42	153	18	86	S	-
31.	<i>Alauda arvensis</i>	19	249	46	202	PM	-
32.	<i>Riparia riparia</i>	-	742	80	298	SV	-
33.	<i>Hirundo rustica</i>	-	411	48	231	SV	-
34.	<i>Anthus campestris</i>	-	78	15	70	SV	+
35.	<i>Anthus cervinus</i>	-	14	-	-	P	-
36.	<i>Motacilla flava</i>	-	74	9	46	SV	-
37.	<i>Motacilla alba</i>	-	46	2	10	SV	-
38.	<i>Lanius collurio</i>	-	78	16	74	SV	+
39.	<i>Lanius minor</i>	-	74	14	65	SV	+
40.	<i>Oriolus oriolus</i>	-	75	22	108	SV	-
41.	<i>Sturnus vulgaris</i>	-	643	36	168	PM	-
42.	<i>Garrulus glandarius</i>	28	97	13	46	S	-
43.	<i>Pica pica</i>	31	61	7	32	S	-
44.	<i>Corvus monedula</i>	27	76	15	56	S	-
45.	<i>Corvus frugilegus</i>	84	218	22	102	S	-
46.	<i>Corvus corone cornix</i>	34	102	7	32	S	-
47.	<i>Corvus corax</i>	13	16	3	11	S	-

48.	<i>Troglodytes troglodytes</i>	20	61	12	48	SV, RW	-
49.	<i>Hippolais icterina</i>	-	32	7	26	SV	-
50.	<i>Sylvia atricapilla</i>	-	65	24	93	SV	-
51.	<i>Sylvia communis</i>	-	51	27	108	SV	-
52.	<i>Phylloscopus trochillus</i>	-	79	9	34	P, SV	-
53.	<i>Phylloscopus collybita</i>	-	144	32	125	SV	-
54.	<i>Phylloscopus sibilatrix</i>	-	39	9	30	SV	-
55.	<i>Ficedula hypoleuca</i>	-	44	8	29	P, SV	-
56.	<i>Ficedula albicollis</i>	-	42	28	128	SV	+
57.	<i>Muscicapa striata</i>	-	42	11	42	SV	-
58.	<i>Oenanthe oenanthe</i>	-	68	13	58	SV	-
59.	<i>Saxicola rubetra</i>	-	84	15	68	SV	-
60.	<i>Saxicola torquata</i>	-	58	10	41	SV	-
61.	<i>Phoenicurus phoenicurus</i>	-	114	12	47	SV	-
62.	<i>Erithacus rubecula</i>	8	63	9	35	SV, RW	-
63.	<i>Luscinia megarhynchos</i>	-	82	16	64	SV	-
64.	<i>Turdus merula</i>	58	139	22	102	PM	-
65.	<i>Turdus iliacus</i>	22	83	-	-	P	-
66.	<i>Turdus philomelos</i>	63	98	30	109	SV	-
67.	<i>Turdus viscivorus</i>	125	85	-	-	PM	-
68.	<i>Parus coeruleus</i>	54	91	12	54	S	-
69.	<i>Parus major</i>	140	284	40	204	S	-
70.	<i>Parus palustris</i>	-	18	-	-	S	-
71.	<i>Aegithalos caudatus</i>	52	94	8	34	S	-
72.	<i>Sitta europaea</i>	60	103	25	130	S	-
73.	<i>Passer domesticus</i>	417	1041	90	492	S	-
74.	<i>Passer montanus</i>	80	301	24	96	S	-
75.	<i>Fringilla coelebs</i>	41	462	62	260	PM	-
76.	<i>Fringilla montifringilla</i>	111	54	-	-	WV	-
77.	<i>Coccothraustes coccothraustes</i>	63	107	14	49	S	-
78.	<i>Serinus serinus</i>	-	53	13	43	SV	-
79.	<i>Carduelis chloris</i>	17	162	21	92	S	-
80.	<i>Carduelis spinus</i>	130	93	-	-	PM, WV	-
81.	<i>Carduelis carduelis</i>	483	433	34	148	S, WV	-
82.	<i>Carduelis cannabina</i>	-	171	6	28	PM	-
83.	<i>Carduelis flammea</i>	-	23	-	-	WV	-

84.	<i>Miliaria calandra</i>	10	112	26	96	PM	-
85.	<i>Emberiza citrinella</i>	100	239	30	134	S	-
86.	<i>Emberiza hortulana</i>	-	36	11	40	SV	+

We can see that, for the investigated site, we found a different phenological status than that for Romania for some bird species. We can explain these exceptions, first of all through the absence of the suitable habitats for the breeding success – to build the nest and to find the necessary food for chicken' surviving in the nest (*Ciconia ciconia*, *Merops apiaster*, etc.). Other species can be summer visitors in the region but non-breeding bird species in the future wind farm's perimeter, visiting this territory just to search food (*Hieraaetus pennatus*, *Pernis apivorus*, etc.).

Some passerines species appear just in passage or during the wintering period, breeding in ecosystems from higher altitudes or in northern areas (*Turdus viscivorus*, *Turdus iliacus*, *Parus palustris*, *Carduelis spinus*, etc.). In fact, including for some constantly recorded species during our fieldwork studies, the breeding population leaves this area going in the south for wintering time, and the birds present during the cold season belong to some northern breeding populations, coming for wintering in the investigated site (*Troglodytes troglodytes*, *Aegithalos caudatus*, etc.).

As we expected, the raptors group had a good representation during the wintering time, the Buzzard (*Buteo buteo*) being the dominant species. We must notice that during the whole wintering period, we had not observed any one exemplar of raptor on the territory from the western limit of the protected area Badeana Forest. In fact, there is the buffer area of the forest and we recorded a very low bird fauna's diversity for the wintertime. For the raptors group, we identified like principal hunting perimeters:

- one area in the northern part of the site, in the vicinity of Balaurului Forest, nearest the southern and south-western limits of the forest to the La Gura Balaurului Valley and Tainita Valley, so, outside of the wind farms' perimeter, the nearest project turbine's positions being situated at 600 – 1200 m distance; in this area, in the wintering time, we met only buzzards (*Buteo buteo* and *Buteo lagopus*), while during the breeding period, we observed individuals of Hobby (*Falco subbuteo*) in hovering flying, one pair be identified like breeding species in this forest;

- a second area, situated also in the vicinity of Balaurului Forest, in the western side of the forest, on the Mariuta Clearing to the eastern limit of Balaurului Valley woodland plantation. In this perimeter, we observed an immature individual of Imperial Eagle (*Aquila heliaca*) hunting for food, in the beginning of December (05.12.2008);

- the third area is situated in the vicinity of Balaurului Forest, too, but far away outside of the wind farm's perimeter, on the eastern side to Crang village's limit,

there being constantly observed, also, 2 – 4 individuals of Raven (*Corvus corax*), that are breeding in Balaurului Forest, but also, beginning from the early spring, some raptor species - Buzzards (*Buteo buteo*), Honey Buzzards (*Pernis apivorus*) and one adult individual of Booted Eagle (*Hieraaetus pennatus*), that could breed in Cringului Forest, situated in the north of the site, the raptor birds being observed flying from and to this woodland ecosystem;

- one hunting territory used by the falcons (*Falco* sp.) was identified between the road and the young woodland plantation from the north of the Badeana Forest, enough far away from the most peripheral turbines in the eastern limit of the future wind farm;

- two areas are delimited in the eastern part of Badeana Forest, nearest Badeana village, completely outside of the wind farm's perimeter;

- another one hunting territory is situated at the south-eastern margin of the site, between Badeana Forest and the last turbines – starting from the spring till the middle autumn, there we observed many times adults and, in late July, juveniles of Buzzard (*Buteo buteo*), Goshawks (*Accipiter gentilis*) and one individual of Eagle Owl (*Bubo bubo*), too; we did not identify the nests of these birds, but we suppose that are situated in a more southern sector of Badeana Forest - the raptor birds have very large breeding territories, searching the food far away from the nest' site;

- in the end, other three hunting territories, used by falcons (*Falco vespertinus* and *Falco tinnunculus*), were identified in the eastern sector of the Piscu Morii Lake and along meadow forest area from the Pereschev rivulet valley, the birds having their nests in the young woodland plantation from the eastern slope of the lake, so, completely outside of the future wind farm's area; during the autumn migration, we met the Buzzards (*Buteo buteo*) and the Goshawk (*Accipiter gentilis*) use one hunting territory in the western side of the lake.

We mention that we did not observe the presence of flyways used by raptor species or Storks (*Ciconia* sp.) inside the perimeter of the future wind farm. In fact, the recorded effectives of these species were very small (table 1). During the migration time, the great majority of the raptor birds were observe passing to or from the northern breeding areas, despite the suitable conditions present in the Balaurului Forest and Badeana Forest.

In the perimeter of the future wind farm and it neighbourhoods, the birds' fauna of the breeding period present a relatively high diversity - 78 bird species, from which 71 are breeding bird species in the investigated territory. During the May month time, we observed single birds or small groups of birds belonging to some species that are winter visitors or just present in passage inside this study area, breeding in the north of Romania or in ecosystems from higher altitudes (*Anthus cervinus*, *Turdus iliacus*, *Turdus viscivorus* or *Carduelis spinus*). As we can see in the table 1, inside the Ivesti - Pogonesti site' perimeter, we not recorded the

presence of the corncrake – *Crex crex*, that is a globally threatened bird species, strict protected in the whole distribution area.

The dominant habitats from this site - forest ecosystems, meadows with small herbs, agricultural lands, isolated or grouping small shrubs and bushes – determine the breeding birds' fauna that is dominated by the typical forest and open lands bird species. The passerines group is recording the greatest diversity (50 breeding species, other four species being observed in passage) and the biggest effectives, too.

As we mentioned before, in Romania, the breeding season of the birds' group is about seven months. It is beginning even in February for some sedentary bird species like the crows (*Corvus corax*, *Corvus frugilegus*) that begin to collect material for the nest's building or to strengthen the old nests in the middle of the last winter month, while some bird species have the second or the third chicks' generation in August (*Hirundo rustica*, *Streptopelia decaocto*).

Starting from the first decade of March, we observed passerine species that use to breed on the open lands like the grasslands and agricultural lands inside the future wind farm's perimeter (*Alauda arvensis* or *Galerida cristata*), beginning the territorial behaviour displays – limiting the breeding territory, occupying, marking and defending the breeding territory through the strong song of the males. The suddenly temperatures' decreasing recorded in the 2009' spring's beginning, forced the birds to interrupted these behaviour displays, manifesting its with higher intensity starting from the last decade of March and, especially, in April.

During the March and April months, other species that use to breed in open lands arrived and began the territorial displays in the area. These are bird species that build the nest from herbs, like a large cup, situated on the ground, with a good camouflage through the surrounded herbs (*Anthus campestris*, *Motacilla flava* or *Motacilla alba*), but also inside some bushes and shrubs, fixing the nest on the base branches or in the dense and high nearest herbs (*Miliaria calandra*). In the open lands, we observed, also, the Wheatear (*Oenanthe oenanthe*), that build it nest on the ground, under some rocks or thick broken branches and between the dense herbs, too.

From the April, can be met the shrikes (*Lanius collurio* and *Lanius minor*), the Whinchat (*Saxicola rubetra*) and the Stonechat (*Saxicola torquata*), that use to build their nests in the shrubs and the highest bushes, using it also, like sitting sites to looking for a prey; normally, these species are flying to the ground for catching their preys.

The mostly of these bird species have the complete clutch just in the ending April or even in the May beginning, despite the starting of the territorial and mating displays in March or in the first part of April.

In the cultivated lands and in the grasslands with shrubs, included in the forest' skirts, we observed the three recorded gallinaceous species in this site

(*Perdix perdix*, *Coturnix coturnix* and *Phasianus colchicus*), all of them hunting game species. These species are polygamous birds and have a hidden life in the dense vegetation, so, the exact counting of the breeding effectiveness is enough difficult and just relative, using the calling males' activity in the first part of the breeding season and the occasional birds' observation along the counting transects established for the monitoring activity in this sites' perimeter.

In the same time, we must mention the existence of one breeding colony in a clay extraction partial active quarry, situated between the villages Ivesti and Pogonesti. We counted there 80 nests occupied by Sand Martin (*Riparia riparia*), other 4 nests occupied by Tree Sparrow (*Passer montanus*) and 10 nest occupied by pairs of House Sparrow (*Passer domesticus*).

Between the bird species that are building their nests inside the villages' perimeter, in the buildings' area or in the orchard trees, there are some species that search its food on long distances, including inside the future wind farm's perimeter (*Hirundo rustica*, *Delichon urbica* or the both species of the genus *Passer*). Other species are not going far away from the villages' limit (*Streptopelia decaocto*, *Apus apus*, *Athene noctua* or *Dendrocopos syriacus*), searching food inside the villages' perimeter.

Like we estimated initially, during the breeding season, we recorded the greatest birds' fauna's diversity inside the forest, in the forest skirts area and just rarely at big distance from the forest's limit, around some bushes and shrubs where the birds can build the nests, but can use its like still-hunting points inside the feeding territories. The woodpeckers, the pigeons and the doves have significantly breeding effectiveness, but all of them are not leaving the forest's perimeter to search and collect/catch food. All the passerine species typical for the woodlands, including the granivorous and frugivorous species, present an insectivorous food regime in this period of the year; if the adult birds can eat a mixed food, after the chicks' hatching, the birds bring to the nest just eggs, larvae, caterpillars and adults of insects. The most important breeding perimeters for the woodlands' bird species are the Badeana Forest, Balaurului Forest and the young woodland plantations nearest the last one.

The White Stork (*Ciconia ciconia*) was observed only one time in the breeding season time - one adult individual was flying upper the young plantation from the northern vicinity of Badeana, going to eastern direction. We not found nests of White Stork in no one from the villages inside or from the neighbourhoods of the future wind farm's perimeter. In fact, the absence of the wetlands can explain this situation – the White Stork is building the nest inside the villages but searching food, especially, in the wetlands and marshes lands' area.

The breeding effectiveness of the raptor birds are very low in this site despite the presence of the large Balaurului Forest and Badeana Forest offer suitable conditions for the building of their typically large nests. The mostly of them are concentrated in

Badeana Forest and Balaurului Forest, while the Little Owl (*Athene noctua*) is breeding inside the villages and hunting there, too, not leaving out the villages' limit.

The autumn migration begins during the first part of August in the area, when some breeding bird species (in the forest and woodland plantations from the nearest and inside the future wind farm) are leaving this region (*Cuculus canorus*, *Streptopelia turtur*, etc.). Starting even from July month, numerous typical forest bird species are forming small or larger flocks, assembling juvenile and adult birds and begin to rove searching more abundant food resources, swinging between the forest skirts and nearest agricultural lands, sometime touching the villages' limit (warblers – *Sylvia sp.*, flycatchers – *Ficedula sp.*, redstarts – *Phoenicurus sp.*, and finches – *Fringilla sp.* and *Carduelis sp.*). In the ending August, some bird species can bring together tens and hundreds individuals, forming the flocks before the migration starting (for example, *Sturnus vulgaris*). The mostly bird species typical for the forests and woodlands are still searching their food inside the forests' perimeter, the birds' fauna's list for the August month including 73 bird species.

During this period, the birds present a very intensive mobility, including the sedentary species, searching food in order to accumulate a thick grease stratum necessary to survive in the wintering time, respectively, for the flying efforts during the migration period. Practically, the birds present daily movements on large distances, flying from the overnight, resting and refuge sites (woodland surfaces, bushes, shrubs, etc.) to the open lands, where can find various and rich food resources.

Beginning from the second part till the end of September month, the vegetation drooped because the intensive dryness phenomenon and the local community starting earlier to harvest the crops. In the ending September, the harvesting activities were finished, including for sun-flower and stems of maize, used like fodder for cattle; the autumn's ploughing were done and some autumn sowings, too, ones of these cultures being germinated (the rape). Then, we could observe some bird species flying to search food art long distances from the forest' skirts and their typical breeding suitable habitats. For example, during the August and in the first middle part of September, we could follow even flocks of bee-eaters (*Merops apiaster*), flying upper the maize and sunflower cultivated lands to catch insects. The typical forest birds were met wandering in small groups between the forest' skirts and nearest open lands (dry meadows, agricultural lands), using the food resources generated through the crops' harvesting and appeared in the herbal vegetation ending periods (fruits, seeds).

In September month, the birds' fauna's diversity decrease (we identified 64 bird species); the summer visitors are leaving the region while the passage species going to the southern wintering areas and the wintering visitors appear in this investigated perimeter (*Turdus iliacus*, *Turdus viscivorus*, *Parus palustris*, etc.). The birds that cannot find more insects (due the arrival of the cold season), begin

assembling in the territories where can find seeds and fruits or collect invertebrates taken out from the soil during the autumn agricultural works in the cultivated lands.

During the October month, we recorded just 48 bird species, one cause being the large periods with abundant rainfalls and low temperatures; the last summer visitors leaved the study region during the first middle of October. An unusual presence for the last decade of October was that of some male individuals of Whinchat (*Saxicola rubetra*). The sedentary bird species reduced their activity, some of them being recorded inside the villages (*Galerida cristata*, *Garrulus glandarius*, *Parus major*, *Parus coeruleus*, *Carduelis carduelis*, etc.). In the same time, we observed some passage species (*Carduelis flammea*) or wintering visitors in this territory, eating the seeds and dry fruits from the forest' skirts area, bushes and shrubs perimeters or even inside the villages (*Turdus viscivorus*, *Fringilla montifringilla*, *Carduelis spinus*, etc.).

In the investigated area, we recorded 15 bird species included in the Annex 1 of the Birds' Directive. During the wintering period, we recorded just five species that are appearing in the Annex 1 of the Birds' Directive. Between these, we must pay a special attention to the Imperial Eagle (*Aquila heliaca*) and to the Peregrine (*Falco peregrinus*), the both being present in the Red Book of Vertebrates in Romania, too. The first is a globally threatened species and strictly protected in Romania - the national breeding effectives are estimated at 5 – 10 pairs, while during the migration time is present with small effectives. We observed just one immature bird, in the northern sector of the site, searching for food in the southwestern part of Balaurului Forest (5.12.2008). The Peregrine present a positive trend in Romania during the last ten years and seems to be a constant presence during the wintering time in the area, but we met this raptor just in Badeana forest, in the neighbourhood of Badeana village, so out of the future wind farm's perimeter.

During the migration period, in the site Ivesti – Pogonesti – Coroiesti - Ciocani, we recorded eleven bird species included in the Annex 1 of the Birds Directive, three of these – the White Stork (*Ciconia ciconia*), the Booted Eagle (*Hieraaetus pennatus*) and the Honey Buzzard (*Permis apivorus*) – being included in the Red Book of the Vertebrates from Romania, too. From our field investigations, these species are not breeding inside or in the neighbourhoods of the future wind farm's area, despite the fact that we recorded some individuals in the breeding period, too. However, these bird species can fly on large distances, searching food in territories situated at more than 10 - 15 km far away from their nests.

The breeding birds' fauna from the site Ivesti – Pogonesti – Coroiesti - Ciocani, includes twelve bird species included in the Annex 1 of the Birds Directive. We mention the breeding presence of some bird species that present a constant negative trend on the European Union's perimeter (*Upupa epops*, *Jynx torquilla*) and of the Ortolan Bunting (*Emberiza hortulana*). These species appear beginning from the April and are breeding in the area with shrubs nearest the pillars with winds'

measurement equipment from the central eastern part of this site, in the grasslands with shrubs and bushes areas inside the agricultural lands and in the skirts of the woodland plantations with developed bushes stratum.

We must notice the presence of some significant breeding effectives for some bird species that have concentrated breeding populations in Romania. For example, the shrikes (*Lanius minor* and *Lanius collurio*) are breeding in the trees along the roads or in the bushes areas, but also unexpected big number of breeding pairs of Collared Flycatcher (*Ficedula albicollis*), concentrated in the perimeter of the Badeana Forest and Balaurului Forest.

CONCLUSIONS AND RECOMMENDATIONS

After one year monitoring, we can estimate that:

the absence of principal migration flyways of birds inside and nearest the future wind farm represents a safety elements for this vertebrates group after the wind farm's development in the area; in the same time, the aquatic and semi-aquatic birds' movements in the Piscu Morii Lake's perimeter during the annual biological cycle take place completely outside of the future wind farm;

the straight-elongated form on the direction north-south of the future wind farm (so, parallel line with the directions of the principal birds' migration flyways on the Romania's territory), with a lateral settlement of two – seven (maximum) turbines in a line, represent another reducing element of the collision risk for the birds and bats populations recorded in this investigated site;

the height elements of the turbines – minimum, about 50 m, respectively, maximum, about 150 m – represent others reduction elements of the collision risk for the dominant species inside the future wind farm's perimeter (the breeding passerines in the dominant habitats from the future wind farm's territory – cultivated lands, grasslands and small isolated shrubs or bushes cluster – use to fly at heights about no high than 30 – 40 m);

the raptor birds groups present small breeding effectives in the area (table 2) and their hunting territories are situated at the limits (Badeana Forest) or completely outside of the future wind farm's perimeter; in order to increase the security level for these birds, we recommend to fix the nearest turbines at distance about at least 500 m from the forest's margins; in the Badeana Forest case, we recommends that the nearest turbines keep a distance about minimum 500 – 800 m to the forest' skirt;

the hunting territories of the winter visitors raptor birds and during the migration time of this group are situated completely outside of the future wind farm's perimeter;

the mostly forest bird species are not searching food outside of the forest's area, just during the wintering period being observed at distances about no more

than 500 m outside of the forest skirts, preferring the nearest road lands or, in some species' case (tits – *Parus sp.*, thrushes – *Turdus sp.*, finches – *Fringilla sp.*, *Carduelis carduelis*), inside the villages;

we assess a possible diminution of the breeding effectiveness and the density of some breeding species inside the future wind farm's area – part of the breeding birds population will leave this perimeter, searching the suitable habitats in the vicinity of the future wind farm; in order to reduce this type of potential impact risk, there could be created small shrubs and bushes clusters outside of the future wind farm's limits, planting exemplars of the existent bushes and shrubs species in the investigated area; between the breeding species, we not recorded any globally threatened bird species, and between the bird species included in different national and international protection laws, just four species included in the Annex 1 of the Birds' Directive (*Anthus campestris*, *Lanius minor*, *Lanius collurio* and *Emberiza hortulana*) are breeding inside the future wind farm's perimeter, flying just very rare upper than 20 m high.

REFERENCES

- HÖTKER, H. 2006: The impact or repowering of wind farms on birds and bats. - NABU Publications, Germany, pp. 36.
- PAPADOPOULOS, A. 1975: Contribution à la connaissance de l'avifaune du district Vaslui. - *Travaux du Museum d'Histoire Naturelle "Grigore Antipa"*, Bucharest, 16: 249 - 264.
- RISSER, P., SAMET, J.M. & co. 2007: Environmental impacts of wind-energy projects. - *National Academy Press*, Washington, pp. 278.
- ***, 2009: Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds.

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