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The Ecology of Buzzards (Aves: Buteo) in the Eastern Part of Moldova (in Romania)

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Introduction

In the natural environment, the intra- and interspecific relations are diverse and very complex. The understanding of these relations will help us anticipate the impact of the human actions on the environment and also implement the most effective measures in order to recreate the plant and animal populations that are being reduced or endangered. Of course, a deep analysis of these relations is difficult to imagine for the near future; nevertheless, we have to identify those items that can show us that an imbalance becomes imminent. Therefore, we should pay attention to the species or to the groups of species that offer information about the conservation status of the habitats.

The predatory animals provide evidence in this respect, as their presence also confirms the presence of their prey. The Buteo type or the buzzard belongs to the category of diurnal predatory birds. Among these, the common buzzard (*Buteo buteo*) is the most frequent species of diurnal predatory birds in Europe. Even if it is a frequent species in Romania, the studies on the ecology of the common buzzard population in our country are very limited. At the national level, there are still some discussions concerning the dimension of this species that, until now, was not subject of any census. There are no studies concerning the habitat preferences and the ecology of nesting in case of the buzzard population in our country. At the same time, the population that winters in Romania is not widely known.

The long-legged buzzard (*Buteo rufinus*) is another species from the Buteo type that is frequently met in the South-East of Europe; it rarely appears in the central part of the continent, but, during the last years, it began to spread to the North (Domashevsky and collab. 2005, Baltag 2010, Baltag and collab. 2012). In our country, the ecology of this species is barely known, and the population-based data, as well as the habitat are still under discussion. The habitat preference is not widely known, and there are no studies concerning the presence of the species during the cold season. In case of the Moldavia region, the species was noticed for the first time in 2007 (Baltag 2010).

The third species, namely the rough-legged buzzard (*Buteo lagopus*), is a winter guest in our country, having a circumpolar distribution. The nesting area is situated between 75°N and 50°N, but the species also winters in the central and Southern part of Europe, Asia and North America. It seems like the population that winters in Romania is decreasing, but the causes of this decrease are not known. The lack of older studies concerning the population that winters in Romania makes even more difficult the quantification of this decline noticeable nowadays.

The study herein has the purpose to present the ecology of the three species of buzzards from the Eastern part of Moldavia (the Romanian territory situated between the rivers Prut and Siret). The research includes aspects concerning the nesting of the common buzzard and of the long-legged buzzard, as well as observations on the hibernation of the three above-mentioned species. Therefore, we will present aspects relating to the distribution, density, selectivity of the habitat, the impact of the climatic factors, as well as the reproductive success of the two species (the common buzzard and the long-legged buzzard). In case of the long-legged buzzard, we will also analyze its expansion to the North through the identification of the main factors that influenced the movement of the population of this species. In what concerns the winter period, we will focus on the distribution, density and selectivity that characterize the habitat, as well as on the impact of the climatic factors on the three species that we have in view.

The data from the research herein was collected during more than 3 years of study. The research required more than 3 500 hours of observation field notes, as well as travels of more than 30 000 km. To this, we may add more than 2 500 hours of data processing and analysis.

1. The history of the research concerning the buzzard species in the Eastern part of Romania

There are several avifaunal studies carried out in the Eastern part of Moldavia (the territory situated between the rivers Prut and Siret), but, until now, there is no study focusing on the diurnal

predatory birds, except for the research carried out during the period 2006-2010 for our Bachelor Degree thesis and for our Master's thesis. Therefore, in this chapter we briefly present the research carried out at the national level that make reference to the area of study (distribution maps, in particular), but also the avifaunal studies carried out at the regional level (in the region of Moldavia) that also refer to the Eastern part of this region.

Analyzing the papers from the "Web of Knowledge" database, we identified a number of 376 papers, at the international level, that make reference to the common buzzard, but only 127 of these papers strictly refer to the above-mentioned species. In what concerns the long-legged buzzard, the number of papers is lower. Thus, we discovered only 27 papers in which the species is mentioned; only 19 papers directly refer to the species we have in view. There are few papers that make reference to the rough-legged buzzard: there are 48 papers in which the species is mentioned, while 12 articles directly focus on the species. This data show us that, at least in the case of the long-legged buzzard and of the rough-legged buzzard, the studies that were carried out until now are limited and that there is little research on the ecology of this species.

2. The natural framework

The structure of the vegetation is important in order to calculate the distribution and the abundance of the diurnal predatory birds (Rotenberry and Wiens 1980); therefore, it represented an important component analyzed in our study. The modifications of the structure and of the distribution of habitats are considered to be the second global cause of the biodiversity degradation (Walker and Steffen 1997). These modifications are caused in general by human activities, such as any form of field use that supposes the conversion of broad areas into habitable or agricultural regions or into forestry zones, a phenomenon leading to the degradation, fragmentation or even destruction of natural habitats (Freitas 2005). Therefore, the analysis of the habitats and of the geographical landform occupied by them is a key element within the study of biodiversity and of population-based trends.

The study herein refers to the Eastern part of Moldavia (in Romania), the area of study being located between the rivers Siret and Prut. The area of study has a total surface of 22 465.3 km², that is about 9,5 % from the surface of Romania. The studied field includes a mosaic of habitats, comprising agricultural fields (56.81%), natural and artificial forests (14.18%), meadows and herbal vegetation (12.64%), artificial surfaces (9.07%), wine-growing regions (3.85%), humid regions and ponds (2.58%) and orchards (0.86%), according to Corine Land Cover 2011 (EEA 2012).

From a geomorphologic point of view, the studied area includes a plateau (in the Northern part) and a fragmented plateau (in the central part); in the South there is a plane. All the area is crossed by rivers whose direction is predominantly from North to South. The altitude of the region is, in general, of 50 – 200 m, but, in the central and Northern part, there are also hills with an altitude of more than 500 m (Dealul Mare, Dealul Ciungi, Dealurile Fălciului etc.), but not greater than 700 m. Therefore, from the point of view of the height, the area meets the ecological preferences of the two species of buzzards that nest in Moldavia (the common buzzard and the long-legged buzzard). Taking into account the small and medium altitudes that characterize the studied area, we may conclude that it has favorable conditions for the hibernation of the two species of buzzards specific to this season (the common buzzard and the rough-legged buzzard).

The climate conditions of the spring-summer period have an important role in determining the nesting territories. In order to include the climatic variables in our analysis, we selected the relevant climatic parameters, resulting from the notes taken during the work carried out within the national network of monitoring the weather conditions from the National Weather Service. The data was accessed through the website of the project *European Climate Assessment and Dataset* (ECA&D). To the data obtained from the national registration system for climate conditions we also added two weather stations located in the studied area (Cîrja, Vaslui county; Iași city, Iași county). In order to get a representative range, we installed 5 data loggers in the areas where the distance between two stations was too large; the temperature and the humidity were monitored through these devices.

These climate data was used during our study in order to quantify certain behaviors or population-based modifications concerning the three species of buzzards that can be noticed in the Eastern part of Moldavia.

3. Materials and methods

Birds occupy a great diversity of ecosystems due to their physiological adaptation and to the main means of locomotion (the flight), even if some species have lost their capacity to fly during their evolution (ostriches, penguins, etc.). Therefore, over time, birds have managed to occupy a large number of trophic positions. Some birds acclimated themselves to the aquatic environment (ember geese, ducks, pelicans, cormorants, waders); they eat fish, invertebrates, algae and other organisms from this environment. Other birds occupied niches in the forestry habitats (thrushes, typical warblers, chaffinches, etc.), while another category of birds developed their agility, managing to become effective predators (eagles, sparrow hawks, falcons, etc.) or opportunistic predators (buzzards, black kites, harriers, etc.). The last category eats prey alive, but also corpses, or even fruits (it is the case of the European Honey Buzzard – *Pernis apivorus*).

The species that are the subject of our study (the buzzards) are medium-sized diurnal predatory birds of the opportunistic type (in particular during the winter period, when there is little food); they can consume small-sized preys (small mammals, birds, lizards, insects, etc.), thus being sufficiently active during the daytime. Having in view the features of these species, the study methods that we used were chosen according to their ecology and behavior in order to collect complete and accurate data.

In order to collect information from the field, we used two classical work methods: the transect method and the fix-point observation. These methods were used in a differential way, according to the data that we wanted to collect, to the period and, last but not least, to the habitat. The methods were adjusted, of course, to the ecological features of the studied species. We created work protocols and forms for each study in order to make easier the collection of data in the same way by each member of the research team. Before their implementation, the work protocols were tested and adjusted according to the application possibilities. In other words, for each work protocol we performed two travels for verification.

4. The ecology of the buzzard species from the East of Moldavia

Diurnal predatory birds are species that predominantly eat animals. In order to get their food, they use the legs rather than the bill. They have a straight eye, strong legs and sharp claws; the muscles of the wings are also strong and their bill is sharp. This category of birds includes a great diversity of species and is widespread.

The buzzards (the Buteo type) are medium-sized diurnal predatory birds that are widespread all over the world. This type includes opportunistic species that can hunt any small-sized or medium-sized prey; nevertheless, the majority of the species prefer mammals, rodents in particular. They often eat small-sized or medium-sized birds (ducks, pheasants, etc.), reptiles, amphibians or even insects. During the periods or in the regions where there is little prey, they can also eat corpses; yet, corpses will always have a secondary place in their diet.

Of the 3 species existing in Romania, only 2 species nest in the country (the common buzzard and the long-legged buzzard), while the third species (the rough-legged buzzard) can be observed during the migration period or as winter guests.

4.1 The common buzzard (*Buteo buteo*)

It is the most common species of diurnal predatory birds that live on the European continent. In case of our area of study, the common buzzard is a permanent presence during the breeding season, as well as during the winter period. The population varies, according to the land use and to the climate features. Even if it is a common species, the density and the ecological characteristics specific to the population living in Romania, during the breeding season and in wintertime, are

barely known.

The observations performed during the two nesting seasons (2011 and 2012) helped us calculate the density of the common buzzard population in the Eastern part of Moldavia. The common buzzard population is not equally distributed on the area of study; the greatest density values were registered in the areas covered mostly by woods and meadows (20 – 36 pairs/100 km²). The average density registered in 2011 is of 6.95 nesting pairs/100 km² (the standard deviation = 0.58, the variation coefficient = 0.47); in 2012, the average density was of 7.5 nesting pairs /100 km² (the standard deviation = 0.34, the variation coefficient = 0.31). As we can see through the analysis of the medium density, the total number of nesting common buzzards registered during each of the two years of study is roughly the same, as we did not discover important variations ($W=1.960$, $p=0.181$). The number of pairs registered in every monitored square during the first year of study is different from the number of pairs registered during the second year of study (*Friedman repeated measures analysis of variance*, all $p<0.001$). This difference is determined by the type and the surface of each habitat.

The species was identified on the whole area of study, being present in almost all the types of habitat. We noted that the species also nests in the area covered with compact forests, with small clearings (the forest Bârnova, in 2006-2011).

During the period of study, we identified 156 nests built by diurnal predatory birds or by ravens. During the 2012 season, the identified nests were monitored in order to check the occupation degree, as well as the species occupying the nest. From the total number of identified nests, 23.72 % ($n = 156$) nests were occupied by the common buzzard, 9,62 % nests were occupied by the Eurasian sparrowhawk, 1,92 % nests were occupied by the common raven (*Corvus corax*), a nest was occupied by the lesser spotted eagle; the rest of the nests remained unoccupied.

The nests identified during our study period are located next to the tree line (the average = 515.88 m, min = 0 m, max = 2468.09 m, CV = 1.088), but at a greater distance from villages and towns (the average = 1378.29 m, min = 251.4 m, max = 3365.38 m, CV = 0.635). These location features of the nests are different from the characteristics of the Northern goshawk, a species that prefers the forests situated next to villages and towns (the average = 712.67 m, min = 218.67 m, max = 2272.03 m, CV = 0.798). Their nests are located in general on South-Western slopes (24%), on Eastern slopes (19%) or on North-Eastern slopes (19%).

Taking into account the fact that this species was not subject of a minute study until now, we do not have a distribution map at the national level. At the same time, the area we have in view in this research has a large surface; therefore, the coverage of this area in order to register the presence of the studied species would require great human and financial efforts. Thus, in order to define the distribution of the common buzzard, we resorted to the modeling of its presence, using the information registered during our field study (8.9 % from the studied area), as well as 45 predictors. The potential distribution of the common buzzard in the Eastern part of Moldavia was obtained using the R 1.15.1 program and the TRIMmaps 1.005 function set. In order to draw the distribution maps, we built 20 prediction models. Of these models, we chose the one that generated the best results after the calculation of the evaluation indicators (MAE, MFE and RMSE). The areal generated by the prediction model occupies 19.58% from the area of study, that is about 4 400 km².

According to our analysis, during the two winter seasons that were subject of our study, the values are very close; thus, during the winter season 2010-2011, we registered a density of 0,425 individuals/km², while for the season 2011-2012 the density was of 0.426 individuals/km². These very close density values make us state that, in case of the common buzzard, the number of individuals was almost the same during the two years of study.

The potential distribution of the common buzzard in the Eastern part of Moldavia during the winter period was calculated using the MaxEnt version 3.3.3 program. In order to draw the distribution maps, we used 35 variables and we built 25 prediction models. Of these, we chose one model for each month from the cold season and one model for each season, respectively.

The data collected from the field show us that the common buzzard population that winters in the Eastern part of Moldavia is influenced by the snow cover and by the daily average

temperature ($p < 0.01$).

4.2 The long-legged buzzard (*Buteo rufinus*)

Taking into account the fact that this species is new in the studied area, and also the reduced number of identified pairs, the following information will be processed more concisely compared to the information detailed in case of the common buzzard. Nevertheless, the data that we will present below is the first information concerning this species living in the studied area.

During the nesting period, we identified 16 territories for the long-legged buzzard. Taking into account the covered area, we can estimate that the nesting population from the Eastern part of Moldavia (in Romania) is of 60-90 pairs. Taking into account the population existing in Dobrogea and the pairs that began to build their nests in the Western part of the country, we consider that the actual population of buzzards living in Romania is around 300-500 nesting pairs.

For the region of Moldavia, taking into account the limited number of identified individuals, we cannot approximate the density of the population during the winter period; nevertheless, we can state that 5-8 observations per season are registered.

The long-legged buzzard is a diurnal predatory bird that is spreading to the North. This expansion can be determined by several variables. We consider that one of these variables is the global warming.

According to our analysis, in case of the temperature values registered during the last 50 years in the region of Moldavia, an increase of more than 0,5°C (Ion and collab. *in press*) was identified. This increase is not homogenous during all the months. The greatest increase for the region of Moldavia was registered in March, when the temperature rose by 1.4°C compared to the beginning of the 20th century.

An interesting aspect is the fact that the species is identified in roughly the same locations during the same season or during two different years. Even if it might be early to state it, we consider that the species is characterized by territorial fidelity. This behavior was also registered in case of the other species of buzzards living on the European continent.

4.3 The rough-legged buzzard (*Buteo lagopus*)

The rough-legged buzzard is a Northern species that winters on the territory of Romania. Its presence during the last years began to decrease considerably, such as individuals of this species are quite rare nowadays. Taking into account these aspects, the information that we will present below will not treat in detail the species, as the number of individuals observed is limited, while our area of study is situated at the Southern limit of the hiemal distribution of the species. This aspect makes us carefully process the data existing in the scientific literature.

In the Eastern part of Moldavia, individuals of this species may be seen regularly during winter, but their number is limited. In this area, the population that winters is decreasing, probably because of the climate changes that allow the species to winter closer to their nesting territories.

We do not know the density values concerning the wintering areas or the population-based movements from this period. During our research (2010-2012), we registered 38 individuals of this species in the Eastern part of Moldavia. This number of registered birds does not allow us to calculate the density value, but we can state that it is a species regularly met in the Eastern part of Moldavia. Nevertheless, the number of individuals is limited. The rough-legged buzzard was registered in general in the Eastern part of the area of study.

Using the MaxEnt version 3.3.3 program, we built models for the registered data. The variables used for the construction of these models are the same as those used in case of the models mentioned for the common buzzard. For this species, we built 7 models, in order to calculate the distribution for the whole season. Because of the limited number of registered individuals, we cannot build models corresponding to each winter month.

For the area of study, the vast majority of the individuals were registered while they were hunting on agricultural fields (55.26 %); the second place in this classification is occupied by the

meadows and mixtures of herbal vegetation (34.21 %). Individuals from these species were also seen while they were flying over villages and reed or while they were hunting in the wine-growing areas. In general, this species is met in low regions (in the river valleys), whose surface is plane and smooth and where they can get food.

5. The conservation of buzzards in the Eastern part of Moldavia

The number of diurnal predatory birds has largely decreased during the last century. 2 species disappeared from Romania (*Gypaetus barbatus* and *Aegypius monachus*), while another 2 species are rarely seen (*Neophron percnopterus* and *Gyps fulvus*). In case of 4 species, the nesting was not registered anymore (*Pandion haliaetus*, *Milvus milvus*, *Aquila clanga* and *Aquila heliaca*), while the situation of another species is uncertain (*Falco naumanni*). The number of the other diurnal predatory birds is very limited nowadays.

The main cause that explains the limited number of diurnal predatory birds is the impact of human actions on the environment. The humans did not take into account the ecological factors and they tried to develop their actions even if this development damages the environment. The fragmentation and destruction of habitats, the use of pesticides and insecticides, the hunting and poisoning are the causes that led to the decrease and even to the disappearance of diurnal predatory birds from certain areas.

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