

**Spatial distribution and breeding habitat characteristics of Golden Eagle (*Aquila chrysaetos*), Long-legged Buzzard (*Buteo rufinus*) and Peregrine Falcon (*Falco peregrinus*) in the Balkan Mountain Range**

(PhD Dissertation)

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**Abstract:** The present study aims to evaluate some natural factors that are key to the selection of breeding habitats of the golden eagle, peregrine falcon and long-legged buzzard in the Balkan Mountain Range, their habitat preferences in relation to human access and human presence in the breeding territories, the prerequisites for the availability of foraging resources in the breeding territories and the status of the populations and the habitats of these three species in the study area based on spatial distribution of the breeding territories. Data about the nest locations were collected. Analyses and maps were created using ArcGIS 10.6. Descriptive statistics, standard parametric and nonparametric tests in STATISTICA ver. 12 were used for the statistical analyses. The degree of heterogeneity of the habitat and prey species diversity in the breeding territories were characterised by a Shannon-Wiener (H) function in PAST software. To determine the topographical heterogeneity of the habitat in the breeding territories, the Terrain Ruggedness Index (TRI) was used. The “least cost path” was defined using the Cost Path tool. Cluster analysis was used to classify anthropogenic objects into relative groups. The prerequisites for the availability of foraging resources in the breeding territories were assessed, applying spatial models of species from their food spectrum. Territories of golden eagle and peregrine falcon had high degree of woodland and pasture and natural grasslands, while those of the long-legged buzzard exhibited a greater presence of shrubby habitats and arable areas. Territories of the three species in the studied area showed low degree of heterogeneity. Golden eagle and peregrine falcon territories were located at higher elevation and had more complex topography than those of the long-legged buzzard. In the studied area, all three species located their nests on cliffs, preferring dominant position of the nests to the surrounding area. Golden eagle and peregrine falcon showed clear preference for nesting on steep cliffs. Long-legged buzzard tended to nest on more sloping terrains. Golden eagle, long-legged buzzard and peregrine falcon did not exhibit a high degree of conservatism regarding the exposure of the nesting cliffs and this factor was not a leading feature in the selection of nesting site in the studied area, however, the nests were found mainly on the southern slopes of the Balkan Mountain Range. The lowest values of the Cost Path were established for long-legged buzzard and the highest values were estimated for golden eagle. Intermediate Cost Path values for peregrine falcon were found. The long-legged buzzard could be considered as the most tolerant to human presence in its breeding territories. The golden eagle have the lowest degree of tolerance and the peregrine falcon is ranked in an intermediate position compared to the other two species, but closer to golden eagle. In the study area the most probable foraging resources for the golden eagle were the rock partridge, the common quail and the European ground squirrel, for the long-legged buzzard – the common vole, and for the peregrine falcon – the mistle thrush and the common wood pigeon. In the most territories of the three species of birds of prey there were prerequisites for the presence of at least several prey species. Reptiles did not make a significant contribution of a food source for the golden eagle and the long-legged buzzard in the Balkan Mountains. Using spatial models as an indirect method for assessing the preconditions for the availability of foraging resources in the territories of birds of prey can be applied as a reliable alternative

approach. We found a regular spatial pattern in golden eagle and peregrine falcon and a random spatial distribution in long-legged buzzard territories. On the basis of the regular patterns found in golden eagle and peregrine falcon, it can be argued that the populations of these two species on the territory of the Balkan Mountain Range are in a relatively stable condition, with an availability of sufficiently suitable habitats, and without shortage of nesting sites. The random distribution of the territories of the long-legged buzzards in the study area may be due to pressure by golden eagle and peregrine falcon when occupying breeding territories, as well as to the fact that in the last several decades the population trend of this species in Bulgaria is fluctuating. The long-legged buzzard showed great ecological plasticity in terms of its nesting sites and breeding habitats, it is tolerant of human presence in its breeding territories and uses widespread species as a foraging resource. This adaptability, along with other factors, may favour the observed range expansion to the north over the past few decades.