Effects of Different Variables on Habitat Selection and Temporal Activities of Wild Animals; The Case of Central Anatolia

Nuri Kaan OZKAZANC[1] and Emir Özay[2]

[1]Bartin University
[2]Eskişehir Metropolitan Municipality

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Abstract

In this study, which was carried out between 2015-2019, were taken 3730 photographs and video recordings with the number of 6380 camera trap days at 142 different points with the camera traps. At the end of the study, 13 different large mammal wild animal species were identified. In the study area, wild boar (Sus scrofa) 845, hare (Lepus europaeus) 634, red fox (Vulpes vulpes) 565, gray wolf (Canis lupus) 549, golden jackal (Canis aureus) 322, red deer (Cervus elaphus) 224, stone marten (Martes foina) 174, European badger (Meles meles) 89, brown bear (Ursus arctos) 86, Eurasian otter (Lutra lutra) 84, jungle cat (Felis chaus) 69, wildcat (Felis silvestris) 52 and Eurasian lynx (Lynx lynx) 28 times have been observed. The distribution of the identified species according to altitude and stand type, and their activities according to months and hours of the day were evaluated. It has been determined that the determined species prefer mixed and degraded stand types, they are more intense between 1200-1400 meters, daily activities are more frequent at night and they are more active in the spring and autumn seasons.

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Emir Ozay Eskişehir Metropolitan Municipality, Art Vocational Training Courses, 26100 Eskişehir

Nuri Kaan Özkazanç University of Bartin, Faculty of Forestry, Departmet of Foret Engineer 74100 Bartin

Correspondence: Nuri Kaan Özkazanç University of Bartin, Faculty of Forestry, Departmet of Foret Engineer 74100 Bartin.*nozkazanc@bartin.edu.tr*

ABSTRACT In this study, which was carried out between 2015-2019, were taken 3730 photographs and video recordings with the number of 6380 camera trap days at 142 different points with the camera traps. At the end of the study, 13 different large mammal wild animal species were identified. In the study area, wild boar (*Sus scrofa*) 845, hare (*Lepus europaeus*) 634, red fox (*Vulpes vulpes*) 565, gray wolf (*Canis lupus*) 549, golden jackal (*Canis aureus*) 322, red deer (*Cervus elaphus*) 224, stone marten (*Martes foina*) 174, *European* badger (*Meles meles*) 89, brown bear (*Ursus arctos*) 86, Eurasian otter (*Lutra lutra*) 84, jungle cat (*Felis chaus*) 69, wildcat (*Felis silvestris*) 52 and Eurasian lynx (*Lynx lynx*) 28 times have been observed. The distribution of the identified species according to altitude and stand type, and their activities according to months and hours of the day were evaluated. It has been determined that the determined species prefer mixed and degraded stand types, they are more intense between 1200-1400 meters, daily activities are more frequent at night and they are more active in the spring and autumn seasons.

KEYWORDS: activities, habitat, mammal, wild animal, variable, Central Anatolia

Among wild animals, which are one of the most basic components of the ecosystem, mammals are a very important group. However, many mammalian wild animal species continue to exist in limited numbers and the region due to local or global scale ecosystem degradation. Mammals are distributed in 108 different geographical regions in the world (Morrison*et. al* ., 2007). One of these regions, the Palearctic region, is divided into 16 sub-regions and three of these 16 sub-regions are located in Anatolia (Turkish Caucasus region, Muş-Şırnak-Van region, and Western Black Sea region). For this reason, the biodiversity of the Anatolian geography is very rich.

Many of the large mammalian wild animals tend to decline and disappear on a global scale. Especially in Europe, this decrease has accelerated due to the increase in the use of natural resources. It is thought that 10-25% of the habitats of these species will disappear by 2050 in Europe alone (Rondinini and Visconti 2015).

Mammals with 3 subclasses, 29 orders, 153 families, 1229 genera, and 6495 species in the world (Burgin et al. 2018) are represented by 171 species, 141 of which are documented in Turkey (Özkazanç, 2012).

Habitat selection for wild animals is a complex and hierarchical process. This selection varies between individuals, mostly on spatial and temporal scales. Although the habitat preferences of many mammal species change according to the seasons, they also vary depending on altitude, land structure, and vegetation. An important factor affecting the habitat selection of the species is the pressure of the predators in that area (Bose et. al. 2018).

Differences in habitat selection are also observed among different individuals of the same species. These differences are under the influence of some factors such as spatial distribution of individuals, resource use, and dominance-recession. While many wild animals can tolerate some factors that influence the selection of large habitats, such as living areas, smaller-scale areas such as nesting sites are more affected by less important factors (Dussault et. al. 2005).

Suitable habitat for a species is an important factor affecting the distribution and abundance of that species. Because the habitats suitable for the species affect the continuity of the population of that species. The main behavioral and welfare factors of wildlife depend on the amount of food, water, shelter, and site security provided by the habitat used. However, many wildlife habitats are being destroyed by human population growth, increasing food demand, expansion of human settlements, anthropogenic developments, and increases in natural resource use. As a result, wild animal populations are decreasing due to the deterioration of natural habitats. Therefore, a clear understanding of the wildlife-habitat relationship is essential for an effective protected area management (Chabwela et. al. 2017).

Habitat selection in wild animals starts with parental behavior in the early stages of life and is determined by the struggle for survival in the later period. In addition, some habitat selection tactics may be repeatable or changeable throughout the life stages of the species. For example, a species' response to habitat disturbances is highly reproducible and can variable throughout the year (Larue et. all. 2018). In recent studies, it is seen that the determination of changes in the behavior of wild animals against the changing environment is taken into account on an individual scale. These studies have measured the temporal stability of individual differences in habitat selection patterns or correlated individual differences in habitat selection and land use patterns with individual differences in life-stage characteristics. However, generally in many studies, population-based habitat selection analyzes do not take into account individual variability.

Wild animals tend to minimize the detrimental effects of major limiting factors within their habitats as large as possible. For this purpose, they prefer to choose habitats were limiting factors are less in large areas. The beginning of these factors is natural enemies, predators, food, and climatic conditions (Dussault et. al. 2005). Regarding this issue, Senft et al. (1987) hypothesize that habitat selection decisions at large scales occur less frequently, but that habitat selection decisions at small scales have more of an impact on the suitability of the site. In addition, Rettie and Messier (2000) suggested that the habitat selection pattern of animals at spatial scales should reflect a hierarchy of factors that potentially limit individual fitness.

In short, the individual suitability of the species allows it to avoid important limiting factors in large-scale

habitat selections of wild animals (ie, throughout the landscape), while less important factors are more impact on selec of small-scale habitats such as nesting areas.

The forests are the most important wildlife habitats. Different forest types, their sub-vegetations, and many river habitats are favored by wild animals and seasonally affect wildlife mobility. Therefore, the protection of these ecosystem reserves is very important for the protection of wildlife (Salvador et al. 2011). For example, closed forests and the structure of the lower vegetation directly or indirectly affect the habitat selection of a species due to changes in its habitat and prey-food preference. This is particularly more effective in the food habitat selection of predatory species (Tomita and Hiura 2021). In general, closed forest stands are preferred more by a lot of wild mammals, while open stands are less preferred (Hodorff et. al. 1988).

Balakrishnan and Easa (1986) emphasize that twenty-four species found in the Parambikulam Wildlife Sanctuary in India prefer certain forests and these preferences are between deciduous and evergreen forests. In a different study, Tsujio and Yumoto (2014) determined that relatively undisturbed broadleaf forest areas in central Japan have the richest mammalian fauna. Again in this study, it has been reported that the mammal fauna decreases with the increase in altitude in mixed forests, coniferous forests with well-developed vegetation are more suitable for some medium-sized mammals, and forests with fruit trees are more preferred.

Intra-species and inter-species competition of wild animals affect habitat choices, and the characteristics of the habitat also affect competition among wild animals in that habitat. For example, changes in water resources or vegetation in the habitat can affect many activities of species such as feeding, sheltering, reproduction and roaming. Constriction in habitats can lead to increased competition and even conflict among species (Lamprey, 1963).

The destruction of habitats used by wild animals by humans is a major threat to wildlife. Habitat selection, which is mainly a result of competition and predation, also allows species to live together. Although terrestrial mammals tend to use different habitats, information on species habitat selection allows for greater efforts to focus on habitats associated with focal species. This too demonstrates the importance of environmental heterogeneity in enabling species to coexist.

The changes that will occur in the habitats of the species may cause their spread to regions with better ecological conditions (forced migration) or extinction in that region, rather than adapting to new conditions (Raia et al. 2011). For example, in a study that stated that the forest cover and the density of the lower vegetation, directly and indirectly, affect the feeding habitat selection of grizzly bears it was determined that the removal of dwarf bamboo which is an important sub-vegetation cover of the region expands the feeding areas of this species (Tomita and Hiura 2021). Again, in a different study, it was determined that wolves mostly prefer high-quality habitats away from humans with high hunting success (Lesmerises et. al. 2012).

An important factor affecting the habitat use and activities of wild animals is time and seasons. For example, seasonal changes in temperature and precipitation in the elephant migration corridors in Kenya significantly affect the availability of water resources and the distribution of elephants in this area (Williams et. al. 2018). Similarly, deer avoid areas with low snowfall in winter avoiding wolves, which are important predators, and prefer surrounded by snow habitats where they can find plenty of food for nesting. Again, many deer species prefer areas that provide protection from snow along the edges of stands where they can find plenty of food during the winter months. On the other hand, female deer with young tend to prefer habitats that provide protection from predators rather than food preference (Dussault et. al. 2005).

In a different study, the habitat preferences and activity patterns of the caracal were investigated and it was emphasized that the species prefers red pine forests up to 450 meters, it is more common in sandstone and volcanic sediment areas, and areas with limestone are not preferred. In the same study, it is reported that although the species is active throughout the day, it reaches the highest level between 24.00 and 06.00 when the activity intensifies in the evening (Ünal et. al. 2019).

In studies on the distribution of wild mammals in different regions of Turkey; Hızal (2008), 32 in Kapıdağ Peninsula, Mengüllüoğlu (2010), 13 in Beypazarı, Çam ve Ölmez (2015) 42 in Sinop, Nabioğlu ve Keten

(2016), 10 in Bolu Yedigöller National Park, Karataş (2016), 66 in Hatay, Gözütok (2017), 23 in Bursa, Özkazanç ve ark., (2017), 13 in Bartın, İlemin (2020) 37 in Muğla, Yorulmaz ve Arslan (2020), 41 in Yozgat, Selçuk ve Kefelioğlu (2020), 47 in Samsun, 32 in Amasya, 49 in Tokat and 34 in Eskişehir identified different mammalian wild animals.

However, most of these studies are limited to fauna detection. Habitat preferences of wild animals and the factors affecting their behavior and distribution have not been examined. Only Özkazanç et al. (2017) stated that hours, months and seasons, height, and stand type are effective on habitat preference, distribution, and daily activities of wild animals. In this study, it was concluded that wild animals are more active at night, their activities decrease in winter, and they are more active in spring, summer and autumn. In addition, it was found that the species in the area are denser between 1300-1500 meters altitude, and mixed forest areas are more preferred. Özkazanç (2019) reported that wild animals prefer mixed stands over pure stands, fir and beech mixed stands over other mixed stands, and healthy and old stands more than degraded stands.

In this context, this study was carried out in order to identify large mammal wild animals and to determine their habitat preferences, temporal activities, populations, and ecological demands in Eskişehir which is a very important transition point for wild animals between Central Anatolia, and Marmara, and Aegean geographical regions.

STUDY AREA

Eskişehir, where the study was carried out, is between 29°58'-32°04' east longitudes and 39°06'-40°09' north latitudes and has an area of 13,653 km^2. The study area is very important in that it is at the intersection of Central Anatolia, Marmara and Aegean regions. In addition, the striking displacement of two different phytogeographic regions at very close distances affects the distribution of living things in the study area. The area is under the influence of the maritime climate of North Anatolia, the semi-arid and cold climate of Central Anatolia and the temperate climate of the Mediterranean. Depending on the altitude, precipitation is 360-380 mm per year. to 600-650 mm (Ekim, 1990). According to the 2015 data of the General Directorate of Forestry, the forest assets of the province are 410,057 ha. (29%). 173.189 ha of this is degraded and 236,868 ha is normal forest.

METHODS

The camera trap observation method was used in the study. Before starting the field studies, foot, excrement, feeding, resting, scraping, friction traces sing of animals and living points such as nests and caves were determined with the trace counting method. A classification was made by looking at the densities of the tracks according to the stand type, vegetation covers and land structure, and the photo trap attachment points were determined. A GPS record was been taken for each camera trap installed (Table1). Camera traps was checked depend on land structure, season, and stand types 15 to 60 days. During the study period, 3730 video and photo recordings were taken at 142 different points with the number of 6380 camera trap days. Can (2008) 1,200, Treves et al. (2010) 8,841, Mengüllüoğlu (2010) 3,699, İlemin (2010) 6,548, Soyumert (2010) 31.603 and Özkazanç et al. (2017) obtained and published their data with 3800 camera trap days. In this context, the value of 6380 camera trap days we reached in our study was deemed sufficient for the conclusion of the study. The data obtained in photo traps were transferred to the computer and evaluated. Each record was examined in detail, and the connection between the environmental data of the recording point and the recording time and the identified species and evaluation were made.

Table 1. GPS data of the camera trap points in field studies .

Trap No	North (N)	East (E)	Height (m)	Trap No	North (N)	East (E)	Height (m)
1	39°59.797	030°51.347	1337	72	40°02.638	030°44.406	561
2	40°00.746	030°50.975	1192	73	40°00.560	030°43.068	650
3	40°00.322	030°53.466	1308	74	40°06.779	030°36.206	1178
4	40°00.306	030°54.062	1271	75	40°07.236	030°35.338	1213

Trap No	North (N)	East (E)	Height (m)	Trap No	North (N)	East (E)	Height (m)
5	40°00.494	030°55.074	1312	76	40°02.192	030°44.313	483
6	40°00.248	030°51.102	1201	77	40°07.133	030°33.888	1210
7	39°58.845	030°50.117	1459	78	39°57.630	030°30.355	1010
8	39°58.533	030°50.151	1459	79	39°58.011	030°30.400	900
9	40°00.386	030°55.240	1180	80	39°58.766	030°30.093	522
10	39°58.431	030°49.488	1633	81	39°59.188	030°30.451	623
11	39°59.200	030°61.642	1416	82	39°56.484	030°48.987	1270
12	39°58.845	030°50.117	1465	83	39°55.874	030°42.189	1244
13	40°00.587	030°53.635	1237	84	39°56.274	030°41.859	1237
14	39°59.084	030°51.029	1382	85	39°56.688	030°41.616	1253
15	39°58.845	030°50.117	1468	86	39°56.399	030°42.205	1203
16	39°58.675	030°52.148	1329	87	39°56.245	030°42.903	1210
17	39°58.204	030°50.252	1463	88	39°57.041	030°56.901	1323
18	40°00.322	030°53.466	1308	89	39°57.387	030°52.562	1375
19	39°57.047	031°03.264	1500	90	39°56.885	030°51.941	1291
20	39°57.295	031°03.800	1555	91	39°57.625	030°52.370	1391
21	39°27.891	030°22.647	1416	92	39°58.163	030°52.001	1350
22	39°27.743	030°22.797	1370	93	39°59.955	030°55.504	945
23	39°29.455	030°23.728	1170	94	39°59.752	030°53.892	1236
24	39°27.448	030°21.959	1660	95	39°59.925	030°54.398	907
25	39°27.572	030°22.719	1390	96	39°59.778	030°54.916	1078
26	39°35.739	030°25.279	870	97	39°59.934	030°54.289	967
27	40°00.064	030°46.892	1215	98	39°59.843	031°09.535	1335
28	40°00.880	030°48.072	1011	99	39°57.504	031°11.870	1531
29	40°00.538	030°47.478	1107	100	39°42.605	031°26.017	822
30	40°00.131	030°46.256	1133	101	39°55.424	031°25.928	1305
31	40°00.722	030°47.754	1118	102	39°55.248	031°29.756	1212
32	40°00.639	030°47.015	1145	103	39°43.210	031°26.266	878
33	39°59.475	030°46.586	1315	104	39°39.533	031°25.895	1040
34	40°01.307	030°47.700	903	105	39°55.446	031°29.274	1247
35	40°00.766	030°47.232	1126	106	39°42.960	031°25.867	848
36	40°00.388	030°47.164	1201	107	39°55.061	031°26.609	1431
37	39°59.746	030°46.188	1246	108	39°56.205	031°28.323	1171
38	40°00.212	030°47.680	1207	109	39°55.065	031°28.081	1212
39	40°00.935	030°47.792	1095	110	39°55.573	031°28.137	1220
40	40°00.154	030°46.620	1223	111	39°57.750	031°07.928	1483
41	40°00.656	030°47.340	1110	112	39°55.044	031°29.099	1256
42	40°00.131	030°47.154	1200	113	39°58.540	031°51.050	1341
43	39°59.839	030°47.248	1260	114	39°58.333	031°10.749	1273
44	39°59.628	030°47.766	1303	115	40°00.155	031°14.957	1487
45	40°01.556	030°49.133	872	116	40°00.359	031°14.821	1511
46	40°02.258	030°49.421	998	117	39°53.825	031°22.446	1436
47	40°02.019	030°48.403	666	118	39°53.418	031°21.842	1331
48	44°33.200	031°40.712	785	119	39°11.532	031°37.502	749
49	40°00.051	030°47.125	1209	120	39°11.727	031°37.508	878
50	40°00.603	030°45.265	1103	121	39°11.622	031°37.770	894
51	40°04.224	030°40.256	1100	122	39°11.815	031°37.647	877
52	40°02.081	030°44.051	637	123	39°10.560	031°36.844	849
53	40°04.956	030°41.625	1052	124	39°11.779	031°37.958	827
54	40°00.528	030°43.028	652	125	39°44.664	030°27.965	757

Trap No	North (N)	East (E)	Height (m)	Trap No	North (N)	East (E)	Height (m)
55	40°01.687	030°44.631	785	126	39°44.650	030°27.948	934
56	40°05.239	030°45.276	1120	127	39°59.441	030°57.273	996
57	40°01.777	030°43.615	692	128	39°58.563	031°09.967	1386
58	40°01.815	030°43.984	605	129	39°56.921	030°57.298	1058
59	40°07.134	030°33.758	1213	130	39°57.519	030°55.899	1196
60	40°01.231	030°43.057	536	131	39°57.620	030°55.559	1293
61	40°02.638	030°45.020	503	132	39°57.412	030°55.591	1260
62	40°02.672	030°44.484	420	133	39°57.220	030°56.616	1249
63	40°00.064	030°43.486	820	134	39°57.459	030°55.849	1230
64	40°02.280	030°44.563	525	135	39°57.022	030°55.580	1196
65	40°03.310	030°44.130	253	136	39°10.548	030°36.934	850
66	40°06.581	030°36.403	1139	137	40°06.443'	030°44.051	935
67	40°02.883	030°04.108	342	138	40°04.631'	030°37.747	643
68	40°06.897	030°36.117	1165	139	39°56.474'	030°55.855'	1106
69	40°03.015	030°44.010	123	140	40°05.686'	030°44.059'	761
70	40°01.184	030°45.170	907	141	40°05.887'	030°43.909'	735
71	40°07.400	030°34.542	1200	142	39°41.922	030°25.642	773

Identification of the observed species, date and time of detection were determined and observation area's informations such as the stand type, height and GPS data were transferred to excel tables. In line with the findings obtained, the behaviors and habitat selction of these species were evaluated depending on variables such as season, altitude and time of day.

FINDINGS AND DISCUSSION

As a result of the studies, 13 large mammal wild animal species were identified in the region. These species by according the numbers of recorded number are respectively boar (*Sus scrofa* -845), European hare (*Lepus europaeus* -634), red fox (*Vulpes vulpes* -565), gray wolf (*Canis lupus* -549), golden jackal (*Canis aureus* -322), red deer (*Cervus elaphus* -224), beech marten (*Martes foina* -174), European badger (*Meles meles* -89), brown bear (*Ursus arctos* -86), Eurasian otter (*Lutra lutra* -84), jungel cat (*Felis chaus* -69), wild cat (*Felis silvestris* -52) and Euroasian lynx (*Lynx lynx* -28) (Figure 1-2).

Figure 1. The number of records of the detected species.

Figure 2. Species identified a. Boar, b. European hare, c. Red fox, d. Gray Wolf, e. Golden jackal, f. Red deer, g. Marten, h. European badger, ı. Brown bear, i. Eurasian otter, J. Jungle cat, k. Wildcat, l. Eurasian lynx.

The wild boar was the most detected species with 854 records, and the Eurasian lynx was the least observed species with 28 records. Lynx, jungel cat, otter and wild cat were fist time detected in the area by this study. The effects of different variables on the habitat selection and behaviors of the identified species are given below.

Stand type

The obtained findings showed that the stand type was effective on the species distribution and habitat preferences. There are 54 different stand types11Explanation of stand types specifics is given in Appendix 1. in the area. Mab3 stand type is the stand type with the most determinations with 304 records. This was followed by stand types BArÇk with 232 records, BÇk with 225 records and BÇkAr with 220 records (Figure 3-4).

Figure 3. The total number of records observed in stand types.

Figure 4. Distributions of determined species by stand types

As can be seen in Figure 4, the stand type preferred by each species varies. The wild boar was determined 91 times in the Çkc2 stand type, 80 times in MÇkbc3 stand type and 3 77 times in Mab stand type. The European hare was seen 140 times in BArÇk stand, 93 times BÇk stand and 85 times in Çkcd1 stand. The red fox, which is the third densest species in its area, was observed 66 times in BÇkAr stand, 62 times in Mab3 stand and 19 times in Çkd/bc2 stand. The stand types in which the other species detected in the area are mostly observed are as follows; gray wolf 101 times in MAb3 stand, golden jackal 54 times in Ma3 stand, red deer 66 times in Z-2 stand, beech marten 30 times in Çkcd1 stand, European badger 16 times in Çzd1 stand, brown bear 20 times in Mçkbc stand, Eurasian otter 73 times in Bk-1 stand, jungel cat 64 times in Bk-1 stand, wild cat 7 times in Mab3 stand, and Eurasian lynx 4 times in BArÇk, BArÇk2, Çkd/bc2, BÇkAr, ArMab2 stands (Figure 4).

It is thought that two important factors are effective in the preference of different stand types in the same area by the species. The first of these is the predator-prey relationship. For example, MAb3, which is the stand type most frequently observed by the grey wolf, is also among the stands where it is mostly seen in wild boar and red deer, which are its most important prey. Similarly, there is an absolute harmony between the stands where the Eurasian lynx is observed the most and the areas where the European hare, which is its most important prey, is observed the most. This shows that hunters tend to prefer their preys selected stand selection. Another factor affecting the stand preferences of wild animals is the seasons. The nutrient regime, which changes depending on the season, causes the species to turn to different stands. While many species prefer areas with less snow cover in winter, this preference changes towards safer but nutrient-rich stands in summer. In this regard, Dussault et. al. (2005) states that wild animals prefer coniferous stands as the best habitat type in which they avoid deep snow cover or predator pressure in winter, whereas these stands have very low food availability. In such a situation, wild animals are exposed to other limiting factors and turn to different stand types to access food. Stands, which are rich in food and have low predatory effects, are preferred more in spring and summer than in winter.

As a result of the observations and evaluations made in general, it can be said that the stand preferences of the species determined in the study area in habitat use are mostly degraded and mixed stands, and pure and protected stands are less preferred.

Altitude

The altitude, which affects the habitat selection and distribution of wild animals was considered as an important and limiting factor for also our study area. It is seen that the species in the area are mostly within the forest border regions and are concentrated between 800 and 1500 meters. The between 1300-1399 meters has been the most preferred altitude limit with 788 records. This has followed by 1200-1299 meters with 735 records and 1100-1199 meters with 392 records. Both the total number of records and the number of observed species decreased as you descended below 800 meters and rose above 1,500 meters. However, considering the habitat characteristics of the jungel cat and eurasian otter, it was only detected between 700-900 meters. Both species were detected in Balıkdamı Wildlife Development Area, which is the most important protected area of the region (Figure 5).

Figure 5. The number of determined species depending on altitude.

51% of the detected species were observed 1913 times in total between 1100-1399 meters. This height layer is the best region in terms of both forest and stand richness. Another reason why this altitude range is more preferred by wild animals is that it is away from human pressure compared to low altitudes and it has better living conditions compared to high altitudes due to reasons such as winter conditions, food and water. The wild boar, which is the most dominant species in the area, was observed 197 times between 1200-1299 meters. The reason why this species shows an extreme elevation between 900-999 meters is due to the active agricultural activities at this altitude. The wild boars here avoid going up to high altitudes, as they have constant and fresh access to agricultural food. Increasing rural migration today poses the danger of wild boars heading to lower altitudes. If we rank the highest number of species depending on the altitude; Eoropean hare 187 times 1300-1399, red fox 166 times 1300-1399, grey wolf 165 times 1330-1399, golden

jackal 73 times 900-999, red deer 37 times 1200-1299, beech marten 44 times 1100-1199, European badger 19 times 1200- 1299, brown bear 22 times 900-999, Eurasian otter 75 times 800-899, jungel cat 43 times 800-899, wild cat 10 times 900-999, Eurasian lynx 9 times between 1100-1199 meters were observated.

There are two different situations in the selection of habitat depending on the altitude in the study area. The first of these has seen in the jackal. According to Demirsoy (1996), the golden jackal is not normally found in places higher than 600 meters in Turkey. However, this species has been found at all altitudes from 100 meters to 1499 meters in the study area. Another extreme situation is that red deer can be seen between 100-600 meters. This elevation ranges are used as agricultural fields. The reason for this species to come to such low altitudes has been interpreted as escaping from harsh winter conditions and predatory gaze. Another finding related to altitude is that there is a connection between the hunter and the prey, just like in the stand type. For example, grey wolf is most common with wild boar and red deer (1200-1299), and Eurasian lynx is with European rabbit (1100-1399) at the same altitudes. Again, depending on the seasons, it was observed that the species in the study area preferred higher altitudes in summer and lower altitudes with relatively less snow cover in winter.

Months and seasons

An important variable that affects the behavior and mobility of wild animals is the months and seasons. The highest number of wild animal observations in the region has made in autumn with 1200 observations and second in spring with 1007 observations. In summer and winter seasons, 748 and 775 determinations were made, respectively. According to the months, respectly 484 records were made in October, 393 in March, 365 in November and 351 in September. January was the month with the least number of registrations with 188 observations (Figure 6).

Figure 6. The number of determined species depending on the months.

A similar rate is observed in the incidence of all detected species depending on the seasons and months. On the other hand, an increase in grey wolf observations is observed only in July. The number of boars, which was 161 on average in autumn, has limited to an average of 41 individuals in winter, spring and summer. For the same periods, the incidence of red deer has decreased from 31 to 14. The decline in boar and red deer, especially during the summer months, may be associated with the separation of these species from the herd to give birth and care for young during this period. In addition, the increase in human activities and forestry practices in their habitats in this period reduces the incidence of the species. Almost all of the species in the region reduce their activities in order to use their limited nutrients in the best way and to spend less energy during the winter months. However, from the beginning of spring, the activities increase, and in autumn, the activities of the species reach the highest level for the purpose of winter nutrition. Seasonal variability also varies between carnivores and herbivores, depending on the prey-predator connection. This situation is more conspicuous among European hares and Eurasian lynxes. In parallel with the increase in European hare density in March, April, May and June, the frequency of Eurasian lynxes increased in the same period.

Seasons and months are also very important because of affecting the habitat characteristics of wild animals. For example, stands with water sources are preferred more in summer and winter periods. Similarly, it is striking that the height distribution of the species detected in the area also changes according to the season. While many species prefer lower altitude habitats during the winter months, they have been preferred more highter altitude in the spring, summer and autumn.

Many wild animals seasonally prefer high-altitude stands more in hot weather and less in cold weather. Although the seasonal and daily activities of wild animals change little with temperature increases in winter, significant decreases in activity occur with temperature increases in summer. During the winter, the activity of the species is minimal when temperatures are at their coldest, while an increase in activity is observed on warmer winter days. In summer, it is seen that the activity increases at low temperatures, and this activity decreases relatively with the increase in temperature..

Hours of the day

Another variable that has an effect on the habitat use activities of the identified species is the time zones. Although most wild mammals are active at night or in the dark, temporal analyzes show that there are exceptions (Figure 7).

Figure 7. The number of determined species depending on the time of day.

It is seen that the daily activities of the detected species start to increase from 17.00, continue to increase all night, and after 07.00 their activities begin to decrease and reach the lowest level during the day. By dividing the total of 3,730 records, which is the total of records of each 24 hours, by 24, the hourly recording average during the study period was calculated as 155. A total of 2,741 views were made between 19:00 and 06:00, when the species are most active and approximately half of the day. The average number of recordings in this hour range has account to be 249 (2,741/11). This value is well above the is 24-hour average of 155. It is clear evidence that these species are more active at night. Although there is a parallelism in the hourly activities of all species, it is striking that the daytime activities of boars, grey wolves and red deer are more than other species. Especially in the daytime activities of grey wolve and boar, the prey-predator connection has draw attention here as well. On the other hand, between 12:00 and 14:00 is the period when the number of species is the least. Brown bear, Eorasian lynx, European badger, wild cat, European hare, Eurasian otter and jungel cat are the species with less than 3 records between 08.00-17.00.

Bu durum Sokak et. almak. (2015), gün ortası sıcaklığının, özellikle yiyecek arama ihtiyaçlarına dayalı olarak, vahşi hayvanların habitat seçiminde termoregülatör ihtiyaçlara davranışsal bir tepki olarak değerlendirmiştir. Günün saatlerine bağlı olarak değişen derecelerde sıcaklık vahşi hayvanlar üzerinde stres yaratır ve buna karşı vahşi hayvanlar günlük aktivitelerinde değişikliklere giderler. Aksi takdirde, saatlik sıcaklığa bağlı olarak birçok türde habitat tercihlerinde değişiklikler meydana gelebilir. Bu, vahşi hayvanların gündüz aktivitelerinin seçiminde bir faktör olarak görünmektedir.

RESULT

Stand type, which is an important criterion in the ecology, distribution and habitat selection of wild animals, is present in 54 different types in the area and significantly affects the activities of the identified species. Mab3 stand type is stand type that observed the most wild animal species in the study area. Generally, it is seen that the detected species are recorded more in mixed stand types where larch or oak are mostly found. Species prefer degraded stands more primarily. The pine species in pure or mixed stands are less preferred by the identified species. The reason for this is the relatively poor living cover layer of these types of stands, the low plant species and quantities on which herbivorous and omnivorous wild animals can feed, the high pine trees and the inability of many wild animal species to find suitable and sufficient hiding places in there. Özkazanç (2019) reported that prefered mixed stands more than pure stands, fir and beech mixed stands are preferred more than other mixed stands, and damaged and old stands are preferred more than healthy and young stands, by large mammal wild animals. In this study which we have done differnt of Özkazanç (2019) are preferred that degraded stands more thanhealthy stands by wild animals. However, the forest structure, which is deteriorated as a result of different human activities, has a significant harmful effect on wild animals. As a matter of fact, Wardell and Nichols (1991) reported that many factors, including mining, logging, fire and plant diseases, cause deterioration of ecology in forests and as a result, wildlife is adversely affected.

When the visibility and activity times of the observed species are evaluated, it is seen that their activities start after 17:00 and continue increasingly throughout the night. Species activities has began to decrease with sunrise and reach their lowest levels after 09:00. Between 09:00 and 16:59 hours is the time period when the activities of the species are the least. Nabioğlu and Keten (2016) determined that the activities of the species they detected were between 19:00-21:59 at the highest level and between 11:00-16:59 at the lowest, Özkazanç et al. (2017) has report that the most intense activities are between 18.00-22.00 and 04.00-08.00, and the least activity is between 10.00-17.00.

Tespit edilen büyük memeli yaban hayvanlarının gün içi aktiviteleri gibi aylara göre olarak aktivitelerinde de benzerlik olduğu görülmektedir. Türlerin hemen hepsi vejetasyon döneminin başladığı ilkbaharın başı

yani Mart ayında ve kış dönemine hazırlıklarının yapıldığı sonbaharın ortalarında yani Ekim aylarında daha fazla kayıt altına alınmıştır. Türlerin aylık aktivitesinin en az olduğu ay ise Ocak ayı olarak belirlenmiştir. Nabioğlu ve Keten (2016)'in tespit ettikleri yaban hayvanlarının sonbahar ve kış aylarında faaliyet gösterdiğini belirlerken Özkazanç *ve ark.* (2017) türlerin Nisan ve Eylül ayları arasındaki kayıtların daha fazla olduğunu, en çok yaban hayvanı kaydının 427 adet ile Eylül ayında en azının ise 11 adet ile Ocak ayında kayıt altına alındığını belirtmektedir. Yapmış olduğumuz bu çalışmada ise foto kapanlar tarafından en çok kayıt 484 adetle Kasım ayında, en az kayıt ise 188 adet ile Ocak ayında olmuştur.

An important variable that affects the distribution of the species in the area and their habitat use is the altitude factor. Considering the altitude, it is seen that the detected species are recorded more between 1200 and 1400 meters. Significant decreases are observed in the number of recorded species at altitudes below 500 meters and above 1500 meters in the area. In this regard, Özkazanç et al. (2017) has stated that big wild animals are recorded more in the range of 1300-1399 meters, there is a decrease in the number of records between 1600-1699 meters, and there is a decrease not only the number of records but also the diversity of recorded species below 1000 meters

In addition, Eurasian otter, jungel cat, wild cat and Eurasian lynx that we identified in this study werenew records for the study area. This is an indication that these species tend to spread in the Central Anatolium.

Although each wild animal has its own general biology and population ecology, these aspirations can vary under local conditions. For this reason, it is very important to determine the characteristics of the species from local to local by re-examining the general morphological, ecological and biological information of the species in local conditions, in determining both intra-species variations and inter-species relations. In the light of the information to be obtained from this studies, wildlife conservation and sustainability studies will be safer and more effective.

The habitats of wild animals are directly or indirectly damaged by the increasing human population, developing technology, increasing consumption needs, increasing construction, agriculture and forestry activities. In addition, illegal hunting threatens the population density of many wild animal species.

With this study, the biodiversity of Eskişehir province, which is an important hot spot for Turkey's wildlife, has been contributed and the habitat characteristics and activities of the identified species have been determined. Protecting the wildlife and biological diversity both in Turkey and in the world and transferring it to future generations in a sustainable way is possible with the wishes of the species and the protection of the natural areas they use. Determining the ecosystem preferences of the existing fauna with such studies will provide a more effective and conscious wildlife protection.

Author Contributions Statement

1. Author Emir Özay: Field studies, installation of photo traps, GPS recordings, determination of stand types 50%

2. AUTHOR Nuri Kaan Özkazanç: Identification of species, analysis of data, drawings, writing of the article and publishing works 50%

Data Accessibility Statement

The data of our article has been saved in the link below. We accept our responsibilities regarding all data.

https://www.movebank.org/cms/webapp?gwt_fragment=page=studies

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APPENDICES:

AgÇkS0a: Larch-Cedar failed afforestation site.

Arb1: Juniper stand with Poles-Pole (8-19.9cm) aged, 1 cover (11-40%).

Arc1: Thin woodland (20-35.9cm) age, Juniper stand with 1 canopy (11-40%).

ArMab2: Juniper-Oak stand under the domination of Juniper with 2 canopies (41-70%) and 2 canopies (41-70%) at the age of Youth-Tender (0-7.9cm) and Poles-Pole (8-19.9cm).

BAr: Damaged Juniper stand. There is no closure.

BArÇk: Juniper-Larch stand under the domination of Broken Juniper. There is no closure.

BArÇk1: Degraded Juniper-Larch stand with 1 cover (11-40%) of Juniper dominance.

BArÇk2: Degraded Juniper-Larch stand with 2 canopy (41-70%) in Juniper dominance.

BARM: Damaged Juniper-Oak stand under Juniper dominance.

BÇk: Degraded Larch stand.

BÇkAr: Degraded Larch-Oak stand under the dominance of Larch.

BÇkM: Deteriorated Larch-Oak stand under Larch dominance.

BÇz: Degraded Red Pine stand.

Bk-1: Swamp-Reed area, the first of the reeds in the section.

Çkab3: Larch stand with 3 canopy (71% and above) in Youth-Dating (0-7.9cm) and Pole-Pole (8-19.9cm) age.

Çkb2: Larch stand with 2 canopies (41-70%) at the Pole-Pole (8-19.9cm) age.

Çkbc2-1: Larch stand with 2 canopy (41-70%) in Pole-Pillar (8-19.9cm) and Thin-wood (20-35.9cm) age, the first of the same stand in the division. Çkbc3: Larch stand with 3 canopy (71% and above) at Pole-Pole (8-19.9cm) and Thin-wood (20-35.9cm) age.

Çkc1: Larch stand with 1 canopy (11-40%) at the age of thin woodland (20-35.9cm).

Çkc2: Larch stand with 2 canopies (41-70%) at a thin woody (20-35.9cm) age.

Çkc3: Larch stand with thin woodland (20-35.9cm) age, 3 canopy (71% and above).

Çkcd\Mbc3: Larch at the age of Thin (20-35.9cm) and medium wooded (36-51.9cm) in the upper layer; Mixed stand with Larch-Oak layered (71% and above).

Çkcd1: Larch stand with 1 canopy (11-40%) at thin (20-35.9cm) and medium wooded (36-51.9cm) age.

Çkcd2: Larch stand with 2 canopies (41-70%) at thin (20-35.9cm) and medium wooded (36-51.9cm) age.

Çkcd2\Mb3: Larch stand with 2 caps (41-70%) in thin (20-35.9cm) and medium wooded (36-51.9cm) age in the upper layer, 3 canopy in the lower layer at the pole-pole (8-19.9cm) age. Larch-Oak layered mixed stand consisting of oak (71% and above).

Çkcd3: Larch stand with 3 canopies (71% and above), at thin (20-35.9cm) and medium wooded (36-51.9cm) age.

ÇkÇscd3: Black pine-Sarwood pine mixed stand under the dominance of Larch, with 3 canopies (71% and above) in thin (20-35.9cm) and medium wooded (36-51.9cm) age. ÇkÇzc2: Larch-Red Pine mixed stand under the dominance of Larch with 2 canopies (41-70%) at a thin wooded (20-35.9cm) age.

Çkd/bc2-1: Larch in upper layer medium woody (36-51.9cm) age, layered mixed stand in Pole-Pillar (8-19.9cm) and thin wooded (20-35.9cm) age in lower layer, first of the same stand in the division.

Lkd2: Larch stand with 2 canopies (41-70%) in thin (20-35.9cm) and medium (36-51.9cm) woodland age.

ÇkMa3: Larch-Oak mixed stand under the dominance of Larch with 3 canopy (71% and above) at the age of Youth-Presence (0-7.9cm).

ÇkMab2: Larch-Oak mixed stand under the dominance of Larch, with 2 canopies (41-70%) at the age of Youth-Tender (0-7.9cm) and Poles-Pole (8-19.9cm). ÇkMbc2: Larch-Oak mixed stand under the dominance of Larch, with 2 canopies (41-70%) in Pole-Pillar (8-19.9cm) and Thin-wood (20-35.9cm) age. Çscd3: Scotch pine stand with 3 canopies (71% and above) at the age of thin (20-35.9cm) and medium wooded (36-51.9cm).

ÇsÇkb3: Scots pine-Larch mixed stand in Poles-Pillar (8-19.9cm) age, with 3 canopy (71% and above) dominated by Scots pine.

Çzab3: Red pine stand with 3 canopy (71% and above) in Youth-Dating (0-7.9cm) and Pole-Pole (8-19.9cm) age.

Çzbc2: Red pine stand with 2 canopy (41-70%) at Pole-Pole (8-19.9cm) and Thin woodland (20-35.9cm) age.

Çzc3: Red pine stand with 3 canopy (71% and above) at the age of thin woods (20-35.9cm).

Çzcd1: Red pine stand with 1 canopy (11-40%) in thin (20-35.9cm) and medium wooded (36-51.9cm) age.

Çzcd2: Red pine stand with 2 canopies (41-70%) in thin (20-35.9cm) and medium wooded (36-51.9cm) age.

Çzd1-1: Red pine stand of medium woodland (36-51.9cm) age, with 1 canopy (11-40%), the first of the same stand in the division.

Is: Settlement area.

Ma3: Oak stand with 3 canopy (71% and above) at the age of Youth-Frequency (0-7.9cm).

Mab2: Oak stand with 2 canopy (41-70%) and 2 canopy (41-70%) in Youth-Dentity (0-7.9cm) and Pole-Pole (8-19.9cm) age.**Mab3:**Gençlik-Sıklık (0-7.9cm) ve Sırıklık-Direklik (8-19.9cm) çağında, 3 kapalılığa (%71 ve üzeri) sahip Meşe meşceresi.

Mb3: Oak stand with Pole-Pole (8-19.9cm) age, with 3 canopy (71% and above).

Mbc2: Oak stand with 2 canopy (41-70%) in Pole-Pole (8-19.9cm) and Thin woodland (20-35.9cm) age.

Mc3: Oak stand of thin woodland (20-35.9cm) age, with 3 canopy (71% and above).

MÇkbc3: Oak-Larch mixed stand under the oak dominance with 3 canopies (71% and above) at the Pole-Pillar (8-19.9cm) and Thin-wood (20-35.9cm) age.

MÇkc3: Oak-Larch mixed stand in thin woodland (20-35.9cm) age, with 3 canopy (71% and above) dominated by Oak.

OT: Forest soil.

Z-1\Water: Agriculture and wetland.

Z-2: Agricultural area, the second of the agricultural area in the compartment.

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Figure_4._Distributions_of_determined_species_by_stand_types.docx available at https://authorea.com/users/521978/articles/594643-effects-of-different-variables-on-habitat-selection-and-temporal-activities-of-wild-animals-the-case-of-central-anatolia

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Figure_6._The_number_of_determined_species_depending_on_the_months.docx available at https://authorea.com/users/521978/articles/594643-effects-of-different-variables-on-habitat-selection-and-temporal-activities-of-wild-animals-the-case-of-central-anatolia

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Figure_7._The_number_of_determined_species_depending_on_the_time_of_day..docx available at https://authorea.com/users/521978/articles/594643-effects-of-different-variables-on-habitat-selection-and-temporal-activities-of-wild-animals-the-case-of-central-anatolia

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