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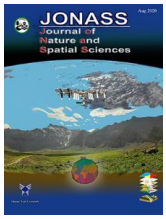

Original Article

Habitat use by Persian Gazelle (*Gazella Subgutturosa*) in Kalmand Protected Area, Iran

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ABSTRACT

Background and objective: Persian gazelle is considered one of the indicators and vulnerable species in Iran. Although, several studies have been so far conducted on this species in different areas of Iran, there is no complete ecological information about the species habitat selection. This study tried to examine the habitat selection of the Persian gazelle based upon quantify habitat variables (pellet groups) in the areas of animal's presence

Materials and methods: Sampling was done in each habitat type using random steady transects with 200 meters' length and 2 meters width, and such habitat variables as percentage of vegetation cover, species richness, and distance from the nearest water source, farms, roads, and areas of human development were measured.

Results and conclusion: The results indicated that the density of pellet groups was different between different plant communities. It was also shown, that habitat variables such as percent cover of plant species *Artemisia siberi*, species richness and distance to road are important factors that influence the habitat selection of this species in Kalmand protected area.

1. Introduction

Persian gazelle (*Gazella subgutturosa*), as the most important herbivore animal in Iran steppe lands, previously has been abundantly dispersed in plain areas of Iran. Owing to the rapid decrease of Persian gazelle population in recent years, this species has been transferred from a near threatened category in 2003 into a vulnerable species by IUCN categorization in 2019 (IUCN 2019). Kalmand protected area includes one of the largest Persian gazelle populations that are dependent on natural habitat. Focused scientific studies have been rarely conducted on the use of habitat by Persian gazelle. The results of study in Shiraz Bamo national park indicated that Persian gazelle avoids spiny plant species, and instead makes a positive relationship with such species as *Astragalus sp* (Nowzari et al. 2007). Study in Isfahan Muteh wild life sanctuary area

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showed that this species mostly uses of *Salsola sp* community (Hazeri et al. 2009). The common point of this habitat type is high acidity of the soil and the existence of so much salt in the soil. The research conducted on Persian gazelle nutrition showed that this species mostly uses sagebrush (*Artemisia sp*) (Dehghani and Parvanehaval 2009). The results of study on evaluation of Persian gazelle habitat suitability in Yazd through using modeling method, indicated that Persian gazelle uses hard soil areas much less, and the survival of gazelles in this area is heavily dependent on farms (Akbari et al. 2004). Mhorr Gazelle established their territories - understood as the home range - just to the north of the point of release, far from any human presence (borders or roads) and in flat areas where the acacia tree cover was abundant (Abaigar, 2020). Other study showed significant interannual variability in the spatial distribution of winter habitat suitability in the potentially fragmented area, which suggests a serious threat posed by railroad construction(Takehiko et al. 2018). The other study confirmed the Persian gazelle dependency on the farms (Farhadi-Nia et al. 2009). Gazelle prefers the areas with low slope and low vegetation cover (Abigar et al. 2005). The current study aimed at determining the use of plant communities by Persian gazelle, and the variables affecting the use of these communities during the summer and autumn of 2013 in order to develop strategies for conservation this species in study area.

2. Materials and Methods

2.1. Study Area

Kalmand protected area with the geographic coordinates of 54º, 20′ - 55º, 13′ N, and 31º, 4′, 36º, 12′ E is located in Yazd province (Fig. 1). There are three main landscapes in this area: plain, hills, and foothills. Likewise, there are three plant communities including *Artemisia sieberi, Artemisia sieberi- Lactuca virosa and Artemisia sp.*

Fig .1- Study area is shown.

2.2. Data Collection

Evaluation of gazelle habitat in summer and autumn seasons was considered in 2013 year. Therefore, random steady transects with two-hundred meters length and two meters width were conducted in the area based on plant communities' distinction whose location was clear using reeds and GPS. We had three repeat of each plant communities. Given that gazelle's pellet decomposition time is up to 60 days in arid areas (Hazeri et al. 2009) and as we identified the areas of animal presence based on its pellet, it was decided that transects be monitored two times in each season and pellet groups be cleaned up once every 45 days (before complete decomposition of pellets). Moving on transects, when we saw pellet groups, a 10 × 10 m plot was conducted. Then, habitat variables such as percentage of vegetation species, number of pellet groups, distant from water sources, farms, roads and environmental monitoring stations were measured and compared with control plots in the non-presence areas. In total 12 transects and 110 plots in presence and absent area were established.

2.3. Analysis

After sorting the data in Excel 2007, they were entered into SPSS16 software. Arc GIS9.3 software was employed to obtain the species distances to the nearest water sources, farms, roads and environmental monitoring stations. Using Kolmogorove-Smirnov test, the data of pellet groups and habitat variables were evaluated in terms of normality. Data were not normally distributed and only pellet groups data were transformed by using Log10. Then, using Leven test, the variables were assessed in terms of variances homogeneity. Homogeneity of variances is considered to be one of the preconditions for parametric tests (Krebs 1999). ANOVA test was used to compare the density of pellet groups between communities, and to compare habitat variables between the three plant communities, Kruskal-Wallis test was employed. Likewise, Mann-Whitney test was used to compare habitat variables between the presence and absence (non-presence) areas. Principle component analysis was used to obtain the most important effective variables in habitat selection. For all analysis, version16 of SPSS software was used.

3. Results

The results of One Way ANOVA test, which was used to compare the density of pellet groups in the three plant communities, showed that there is a significant difference between the three plant communities in terms of pellet groups' density (P= 0.03, F= 3.69). The results of this test are given in Table (1) .

Table 1- One way ANOVA test for compare pellet groups between plant communities

Variables	f	X2	F	P
Density of pellet groups	2	0.27	3.69	0.03

The results of Kruskal-Wallis test that was used to compare habitat variables in the three plant communities, are given in Table 2. The test revealed that there is a significant difference between the three communities in terms of such variables as soil

percentage, the percentage of total vegetation cover, the percentage of *A. sieberi*, *Lactuca virosa* and species richness (P<0.05).

Table 2- Kruskal-Wallis test show compare habitat variables between three communities

P	f	X2	variables
**0.00	2	23.84	Soil percent
**0.00	2	23.84	Vegetation cover
**0.01	2	8.02	Distance to the nearest water
**0.00	2	28.55	Distance to the nearest field
*0.03	2	7.01	Distance to the nearest road
**0.00	2	44.49	Distance to the nearest monitoring station
**0.00	2	21.42	Richness
**0.00	2	14.78	Vegetation of *Artemisia Siberia*
**0.00	2	15.23	Vegetation of *Lactuca virosa*
0.61	2	0.96	Vegetation of *Acanthophyllum maimanense*
0.00	2	20.61	Vegetation of *salsola sp*
**0.00	2	14.25	Vegetation of *Astragalus sp*
1.00	2	0.00	Vegetation of *zygoplyllum sp*
0.37	2	1.96	Vegetation of *Onopordon leptolepis*
0.10	2	4.47	Vegetation of *launaea acanthodes*

Mann-Whitney test was used to compare pellet groups in two seasons of autumn and summer, that the results showed there is no significant difference between two seasons in terms of pellet groups' density (P= 0.44). The results of this test are given in Table 3. Mann-Whitney test results for comparing habitat variables between the presence plots (with pellet) and non-presence plots indicated that there is a significant difference between the percentage of *Astragalus sp*, *Onopordon leptolepsis*, and *Acanthophyllum maimanense* in these two areas (P<0.001).

Table 3. Mann - Withney analysis for compare density of pellet groups between summer and autumn

Variables	Z	Mann-Whitney U	P
Density of pellet groups	-0.76	79	0.44

4. Discussion

Our study showed a significant difference between the densities of pellet groups in the three plant communities. The most density was found in sagebrush-wild lettuce community. This community is richer, topographically flatter, and closer to farm and water sources compared with two other communities, which helps an animal survive.

Moreover, the high percentage of the community's cover, more than other communities helps the animal camouflage. The current study, agreement with other studies conducted in Iran such as Akbari et al. (2004) in Kalmand and Farhadi-Nia et al. (2009) in Mian-dasht area, showed that Persian gazelle has a tendency to farms and that trends in water is an important factor in selection the species summer habitat. The study is also agreement with the studies conducted by Henley et al. (2007) and Attum et al. (2012), as it showed that there is a positive relationship between the gazelle's presence and its access to water sources. Likewise, in a small-scale, the higher percentage of sagebrush-wild lettuce community in comparison with other communities helps the animal to camouflage. Our study is also in line with Abaigar et al. (2005) that found out gazelle selects the areas with low vegetation cover, in macro scale, steppe areas have thin vegetation cover. However, the study was not in agreement with the study conducted by Lawes and Nanni (1993), which showed there is no relationship between vegetation cover percentage and Dorcas gazelle. As this plant community is located near environmental monitoring station, it provides the species with more security. Therefore, many factors in this community contribute to the animal survival and were selected preferably by the species. Our results indicated that habitat selection is not different in summer and autumn. That is, because of reduced rainfall and habitat's loss of quality. According to our results, there is a significant difference between this species presence and non-presence areas in terms of such variables as vegetation covers of *A. seberi*, *Astragalus sp*, *O. leptolepsis*, and *A. maimanense*. The high percentage of *A. sieberi* coverage in the presence areas confirms that *this species*is a preferable species for the Persian gazelle. In this regard, the study confirms the results obtained by Dehghani and Parvaneh (2009) and Hazeri (2009). The higher percentage of *Astragalus sp* coverage in the presence areas indicates that this plant is not only a food source for the gazelle but also it can be used as a shelter and camouflage for the animal, that the result is in agreement with the results of Nowzari et al. (2007) conducted in Bamo National Park in Iran. The spiny species of *O. leptolepsis* and *A. maimanense* are more in the non-presence areas. It seems that Persian gazelle avoids spiny species and *A. maimanense* is not preferred by the gazelle because of its woodiness. Therefore, it seems that Persian gazelle's survival in Kalmand protected area depends upon sagebrush-wild lettuce community. The protection of these area elements is therefore critical for the conservation of the Persian Gazelle in Iran.

5. Conclusions

The results indicated that the density of pellet groups was different between different plant communities. It was also shown, that habitat variables such as percent cover of plant species *Artemisia siberi*, species richness and distance to road are important factors that influence the habitat selection of this species in Kalmand protected area. Our results can provide useful information for the planning of conservation measures for the species.

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Declarations

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Code availability (Not applicable

REFERENCES

Abaigar, T. , Cristina Martínez, Zouhair Amaouch, Mohamed Alifal li Lemdimigh, Sid'Ahmed El Makki, Mohamed El Mokhtar,Mohamed L. Samlali, Pablo Fern_andez de Larrínoa, Rodriguez-Caballero Almería, E. (2020) . Habitat requirements of the Mhorr gazelle: What does this species need to survive in the wild? *Global Ecology and Conservation* 24 (2020), 1-12. https://doi.org/10.1016/j.gecco.2020.e01389

Abaigar, T., Cano, M., & Sakkouhi, M. (2005). Evaluation of habitat use of a semi-captive population of Cuvier's gazelles Gazella cuvieri following release in Boukornine National Park, Tunisia. *Acta Theriologica*, *50*(3), 405-415. https://doi.org/10.1007/BF03192635

Akbari H, Behrozirad B, Kiabi, B. (2008). Investigation habitat suitability by Gazelle in Kalmand protected area. *Environment Journal* (Persian language), (34) 113-118.

Attum, O., & Mahmoud, T. (2012). Dorcas gazelle and livestock use of trees according to size in a hyper-arid landscape. *Journal of Arid Environments*, *76*, 49-53. https://doi.org/10.1016/j.jaridenv.2011.07.002

Dehghani M , Parvaneh Aval, E. (2009). Determine quantity of protein in plant species that prefered by Gazelle in Kalmand protected area. *Journal of Ecology,* (Persian language) ,(4), 594-598.

Esmaeili, S., & Hemami, M. R. (2013). Utilization of harvester ant nest sites by Persian goitered gazelle in steppes of central Iran. *Basic and applied ecology*, *14*(8), 702-711. https://doi.org/10.1016/j.baae.2013.10.002

Farhadinia, M. S., Esfandabad, B. S., Karami, M., Hosseini-Zavarei, F., Absalan, H., & Nezami, B. (2009). Goitered Gazelle, *Gazella subgutturosa*: its habitat preference and conservation needs in Miandasht Wildlife Refuge, north-eastern Iran (Mammalia: Artiodactyla). *Zoology in the middle east*, *46*(1), 9-18. https://doi.org/10.1080/09397140.2009.10638322

Hazeri F, Hemami M, Khagedin, J .(2009). Habitat use by Persian Gazelle in Motte wildlife sanctuary. *Science and Agriculture Journal* (Persian language),(48),427-435.

Henley SR, Ward ., Schmidt, D. (2007). Habitat selection by two desert-adapted ungulates. *Journal of Arid Environments* (70), 39-48. https://doi.org/10.1016/j.jaridenv.2006.12.007

IUCN Red List of Threatened Species. http://www.iucnredlist.org. Accessed Jun 2019.

Krebs, CH J. (1999). *Ecological Methodology*, Benjamin /Cummings publication.

Nanni R. F, Lawes M. J . (1993). The density, habitat use and social organisation of Dorcas Gazelles (*Gazella dorcas*) in Makhtesh Ramon, Negev Desert, Israel. *Arid Environments,* (24), 177-196. https://doi.org/10.1006/jare.1993.1016

Nowzari H, Behrouzi Rad B, Hemami M.R. (2007). Habitat use by Persian Gazelle (*Gazella subgutrrosa*) in Bamo national park during Autumn and winter. *Acta zoologica Mexicana*,(23), 109-121. https://doi.org/10.21829/azm.2007.231560

Takehiko Y.Ito·Yumi Sakamoto·Badamjav Lhagvasuren·Toshihiko Kinugasa, Shinoda, M. (2018). Winter habitat of Mongolian gazelles in areas of southern Mongolia under new

railroad construction: An estimation of inter annual changes in suitable habitats. *Mammalian Biology*, (93), 13-20. https://doi.org/10.1016/j.mambio.2018.07.006

Ziaie, H. (2008). Mammals of Iran. Second edition. 405 p.