# How Many Persian Gazelle (*Gazella subgutturosa*) Can Graze on Golestan National Park of Iran?

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# How many Persian gazelle (*Gazella subgutturosa*) can graze on Golestan National Park of Iran?

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## Introduction

Golestan National Park, with an area of 98,000 hectares and diverse fauna and flora is one of the famous national parks in the Middle East. Carrying capacity was analysed based on available forage and dry matter demand of Persian gazelle (*Gazella subgutturosa*) in spring and winter on steppe parts of Golestan National Park. The Persian gazelle is the most important ungulate species within the arid regions of Iran as well as other countries in the Middle East, Central Asia, and Western China (Farhadinia *et al.* 2009). This species currently categorized Vulnerable (VU) (IUCN Red List 2012). Although gazelle are almost extinct in most parts of Iran, significant population of gazelle live in steppe habitats of the park. In order to manage this species inside the park, and increase its numbers, it is important to determine the carrying capacity of gazelle habitats inside park.

## Methods and materials

The gazelle habitat of Golestan National Park is located between longitude 55°43' to 56°17' E and latitude 37°16' to 37°31' N. The plain parts of this park have warm, dry summers, and cold winters. The MAP is 300 mm and the MAT varies between 11.5 to 17.5°C. Vegetation types of study areas are shown in Table 1.

Standing yields were measured by clipping edible forage in systematic 1-$m^2$ plots along each randomly placed 200m transect in the gazelle habitat. Available dry forage based on growth forms for two seasons were compared by using t-test. To calculate the available forage per hectare per season (AF/ha/season), utilisation factors (UF) of 50 and 70 percent were used for spring and winter respectively. Daily forage demands of gazelles were calculated based on AUM in Iran. The Society for Range Management in Iran (Mesadghi, 1993) defines an animal unit as one mature (40 kg) sheep which would be expected to consume 2 kg dry forage per day or 60 kg per month (AUM). The average weight of a gazelle is about 20 kg and AUM's equivalent for gazelle is assumed to be approximately 30 kg dry forage per month (AUM) and 90 kg per season (AUS). The total usable forage for all vegetation types in each season (TUF) is calculated by the products of $\sum$(SA) ×$\sum$(DM) ×UF and grazing capacity of the study area in each season is TUF/AUS.

Evaluating vegetation composition and available forage during two seasons revealed that shrubs (*Artemisia herba-alba* and *Salsola rigida*) and perennial grasses (*Poa bulbosa* and *Stipa barbata*) are dominants species at all times. According to data from direct observations, gazelles feed on these dominant plant species. The analysis of variance reveals significant difference among seasons in term of biomass available for gazelle.

## Results

The carrying capacity of the study area for spring and winter are shown on Table 2.The results showed a higher maintenance carrying capacity than the actual number of gazelles present, but gazelles still move outside the park and are killed by villager. It seems that low vegetation diversity, low percent of protein in main plant species of *Artemisia herba-alba* and lack of enough water stands in the park are the main reasons for gazelle movement to outside the park. As well as this problem, hunting, inadequate protected area coverage, and inefficient administration, have caused the decrease of gazelle populations below the carrying capacity at Golestan National Park.

**Table 1. Vegetation types, total and suitable area, and number of transects. Suitable area calculated after omission of buffer zones.**

| Vegetation type | Total area (TA) (ha) | Suitable area (SA) (ha) | Number of transects |
|---|---|---|---|
| I : *Artemisia herba/a lba/Eremopyrunbonaris/Anabasisaphylla* | 678.6 | 361.2 | 4 |
| II: *Artemisia herba- alba /Salsola rigida* | 968.6 | 633.8 | 4 |
| III: *Artemisia herba- alba/ Salsola vermiculata/ Stipa barbata* | 205.0 | 86.3 | 3 |
| IV: *Artemisia herba- alba/ Erocia ceratoidea /Stipa barbata* | 865.1 | 620.1 | 4 |
| V: *Artemisia herba-alba/ Aellenia sp/*Annual forbs | 847.7 | 672.7 | 5 |
| Total | 3565.1 | 2374.2 | 20 |

**Table 2. Usable forage production and grazing capacity of study areas for spring (50% PUF) and winter (70 % PUF).**

| Vegetation type | Suitable area (ha) (SA) | Spring dry matter (kg/ha)(SDM) | Spring usable forage (SA×SDM×PUF) | Winter dry matter (kg/ha)(SDM) | Winter usable forage (SA×SDM×PUF) |
|---|---|---|---|---|---|
| I | 361.2 | 131.4 | 23738.7 | 10.55 | 2667.5 |
| II | 633.8 | 284.6 | 90194.0 | 31.90 | 14153.4 |
| III | 86.3 | 557.6 | 24078.8 | 57.70 | 3488.0 |
| IV | 620.1 | 351.0 | 10884.1 | 72.60 | 31515.0 |
| V | 672.7 | 181.4 | 61100.0 | 21.76 | 10247.8 |
| Total | 2374.2 | 301.2 | 209995.8 | 38.90 | 62071.8 |

Grazing capacity for spring = 209995.8/90≈2333 and grazing capacity for winter = 62071.8/90≈690 gazelles

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## Conclusion

The carrying capacity of gazelle habitats in steppe areas of Golestan National Park was estimated to be more than the current stocking rate. Why do these areas with high carrying capacity have fewer gazelle? Why do some gazelle move outside the park during winter, even when numbers are below food-limited carrying capacity?

The basic model to determine carrying capacity was dependent on forage quantity or total biomass only, so it assumes that all forage meets minimum nutrient requirements. In the other word if forage quality is limited, the basic model will overestimate carrying capacity because all biomass is not of the same quality (Caughley, 1994). Also, in the study area, the amount of forage which was wasted through wind has not been calculated. The distribution of gazelles in some habitat areas were not uniform because of inaccessibility, distance of water sources and insecurity (Farhadinia *et al.* 2009). Consequently gazelle focus more on vegetation types II, I and V, while they avoid vegetation types III and IV because of unsuitable soil, increased erosion, rocky beds and foothills. Therefore it is possible that forage production of some parts of the study area that were calculated in terms of carrying capacity were not used by gazelles.

## References

Caughley G (1994) Directions in conservation biology. *Journal of Animal Ecology* **63**, 215-244.

Farhadinia M, Esfahani BS, Karami M, Hosseini-Zavari F, Absalan H, Nezami B (2009) Goitered gazelle Gazella subgutturosa Guldenstaedt, 1780: its habitat preference and conservation needs in Miandasht Wildlife Refuge, northeastern Iran. *Zoology in the Middle East* **46**, 9-18.

IUCN Red List ( 2012) http://www.iucnredlist.org.

Mesdaghi M (1993) Rangeland management in Iran. Razavi Cultural Fundation, Mashhad, Iran (in Persian).