Plant species diversity on protected and non-protected areas of Golestan National Park and vicinity areas

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Introduction

It is important to monitor the status of native rangeland vegetation in order to maintain existing grassland remnants which are valuable for wildlife. In the Steppe region, there has been concern that grazing of late-successional eco-systems may decrease plant species diversity on a local and regional scale and adversely affect rare, threatened, or endangered species. Native vegetation is the best indicator of the potential productivity of a specific location. Range-land herbage production is important for multiple land uses such as livestock production, wildlife food and cover, and protection against erosion. In eastern Oregon, variability in rangeland productivity is linked to the amount and timing of precipitation received over the winter and early summer (Sneva, 1982). Estimates of above-ground plant production have been reported for many sites in the protected and non-protected areas of northeastern of Iran as well as around the world. Plant species diversity in this study was viewed at the alpha level, that is, the number and relative abundance of species within a particular habitat type (Whittaker 1975).

The objective of this study was to determine the productivity, species composition, and diversity of a steppe and semi-steppe rangeland in northeastern Iran.

Methods

This study was carried out at the Golestan National Park (GNP). The park has been a protected area since 1957 and is one of the most famous national parks in the Middle East because of its verdant and virgin forest and diversity of flora and fauna. It is located to the east of the Caspian Sea between longitude $55^{o}43'$ and $56^{o}17'$E and latitude $37^{o}16'$ and $37^{o}31'$ N. The study was conducted in a protected and non-protected area of GNP (located between latitude $37^{o}18'$ to $37^{o}22'$ N and longitude $56^{o}07'$ to $56^{o}15'$ E). This area is the only habitat of the Persian gazelle in GNP. The altitude in our study area ranged from 1100 to 1500 m and the climate was arid to semi-arid. The annual precipitation is less than 200 mm and the annual temperature is 11.9^{o}C from April to October and 10.5^{o}C from December to March.

We estimated canopy cover and diversity of rangelands across 115, $0.25{\times}0.65$ m^2 plots in protected areas and 80, $0.25{\times}0.65$ m^2 in non-protected areas. Canopy cover classes were estimated visually based on the Daubenmire Method

(Daubenmire 1959). Cover classes were: $0 = 0\%$; $1 = 0.01$-1%; $2 = 1.1$-5%; $3 = 5.1$-25%; $4 = 25.1$-50%; $5 = 50.1$-75%; $6 = 75.1$-95%; $7 = 95.1$-99%; and $8 = 99.1$- 100%. Canopy cover was estimated for each plant species having canopy within plot boundaries. Diversity was calculated using four indices: richness, the total number of species (S) tallied per $0.25{\times}0.65$ m^2 plot, heterogeneity (H), and evenness (EH) estimated by the Shannon-Wiener formula (Krebs 1972), where, $H = - \Sigma\, pi \ln pi$ and pi – the relative percentage of standing crop of individual species on each plot or site. Standing crop was used as a measure of the species abundance in diversity calculations. Heterogeneity index considers both richness and evenness components of diversity; that is, the number of species and evenness of their abundance. Species frequency was calculated as the number of times (or plots) an individual species was present in the study sites.

Standing crop and cover, as well as the measurements of every growth forms were generated and separated using Minitab 16.

Results

A total of 42 plant species was found across the study sites, with approximately 39 and 17 plant species respectively occurring in protected and non-protected areas. For the protected area the Shannon diversity index was 3.5 with evenness in species abundance being 0.95 and for the non-protected area the Shannon diversity index was 1.64 with an evenness of 0.58. Results showed that the number of species, diversity and evenness in protected area was approximately 2 times higher than the non-protected area. Almost 80% of the plant species found in our study in both areas were native perennial shrub (e.g. *Artemisia herba-alba*, *Salsola rigida* and *Anabasis setifrra*) and grass species (*e.g. Stipa barbata*, *Poa pratensis*, *Agropyron cristatum* and *Festuca ovina*).

In addition, total canopy cover of vegetation in the protected area was 30% (approximately 15% shrub+9% grass and 6% forbs), which was higher than that of the non-protected area (13% cover=7% shrub+ 3.5% grass+ 2.5% forbs). Productivity of the protected area (200kg/ha) was also much higher than that in adjacent non-protected areas (80 kg/ha).

Conclusion

The study show that the current year's standing crop in the study area varied greatly between the protected and non-protected areas. Moreover characteristics of the native rangelands as measured by standing crop, plant diversity, and coverage percentage will have effect on future livestock or wildlife and conservation management decisions.

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