

# Floristic composition and species richness model in winter rangelands of northeastern Iran

A. Rashtian and M. Mesdaghi

Department of Range Ecology, University of Agricultural Sciences, Gorgan, Iran, Email: arashtian@yahoo.com

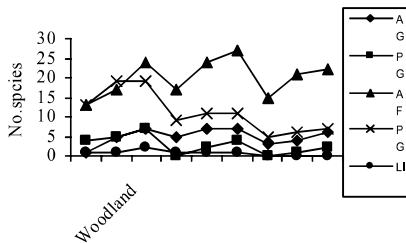
**Keywords:** flora, vegetation type, species richness, life form, grazing

**Introduction** Due to the variable annual rainfall, the plant communities of rangelands in northeastern of Iran are fluctuating and the productivity is highly variable. This ecosystem covers about 500,000 ha and is one of the important winter ranges in Iran. In this fluctuating ecosystem, species diversity and floristic composition are changing annually (Pabot, 1967). Under heavy grazing most of the range species were extinct, but under light and moderate grazing, species richness was improved, fitting with the humped-back model (Wilkinson, 1999). The objectives of this research were 1) to determine floristic composition in three vegetation types and 2) to show the effects of rainfall, slope, aspect, and elevation on species diversity.

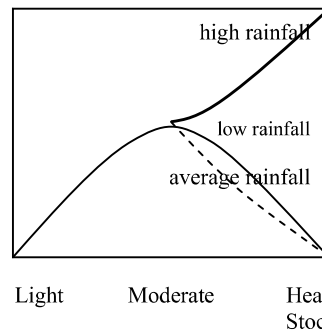
**Material and methods** The flora of range species were collected from representative stands of three vegetation types of woodland, grassland, and shrubland and classified according to Raunkauer's life forms. Species richness was measured using a modified Whittaker's plot. The simple regression model:  $S = \beta_0 + \beta_1 \log X + \epsilon$ , was used, where S is species richness,  $\beta_0$  is the intercept,  $\beta_1$  is the slope of regression line,  $\epsilon$  is random errors, and X's are the plot sizes of 0.1, 1, 10, 100, and 1000 m<sup>2</sup> (Stohlgren *et al.*, 1995). A group regression model was used (Zar, 1999) to compare changes in species richness per unit area ( $\beta_1$ ) and the number of species in the smallest plot ( $\beta_0$ ).

**Results** The study area includes 198 plant species belong to 133 genus and 44 families. There were significant differences in richness based on the longevity of species in the three vegetation types ( $p < 0.05$ ). The richness of annuals is higher than perennials in all vegetation types. The biological types of therophyte were dominated in all vegetation types. There were significant differences among biological types and life forms ( $p < 0.05$ ) and the trends of life form from shrubland to woodland are shown in Figure 1. Plant richness was usually higher in northern compare to southern aspect .

**Discussion and conclusions** In general, annuals and ephemerals are dominant, which are the characteristic of areas with highly variable rainfall. When there is enough rain, especially in spring, the seeds of many annuals germinate and species richness much increases, so the diversity of this ecosystem is highly variable (Mesdaghi, 1993) and the results contradict the humped-back model. In a dry year, the plant diversity decreases and the pastures are in poor condition (Figure 2).



**Figure 1** The trends of growth form in different fluctuating annual grassland vegetation types



**Figure 2** The plant diversity model for communities under three levels of rainfall

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