



Investigating The Response of Grazed and Enclosed Plant Communities to Short-Term Wet and Drought Conditions: A Case Study of South Khorasan Semi-Desert Ecosystems

Moslem Rostampour^{1*}, Alireza Eftekhari²

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Expanded Abstract

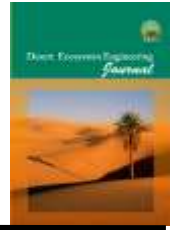
Introduction: Considered two important contributing factors in reducing biodiversity in rangelands, drought, and grazing influence the performance of natural ecosystems. Moreover, plant communities respond variously to drought periods under different management conditions. However, while many studies have so far been conducted on the response of plant communities to drought, it is not clear whether the ecosystems are more resistant or more vulnerable to drought. Therefore, this study sought to examine the impact of grazing intensity (including lenient, moderate, and heavy grazing) on vegetation characteristics (such as canopy cover, forage production, and species diversity) of semi-desert ecosystems of South Khorasan province under normal, wet, and drought conditions.

Material and Methods: This study attempted to investigate the structural properties of *Salsola richteri* and *Artemisia sieberi*- *Zygophyllum eurypterum* communities in the grazing and enclosed rangelands under short-term wet and drought conditions. To this end, canopy cover, density, forage production, and the richness and diversity of species were measured according to the Guidelines set by the Iranian National Program for Monitoring Rangeland Quality. Moreover, the species abundance index was used to assess plant diversity indices. Accordingly, after recording the plant density values and converting them to abundance ones, the species richness, dominance, diversity, and evenness were calculated using the *adiv* package. On the other hand, the Standard Precipitation Index (SPI) was used to assess the drought. Finally, the statistical analysis of the data was performed using the Wilcoxon signed-rank test and permutation test.

Results: The results of the SPI analysis indicated that the *Salsola richteri* community experienced normal and very dry years in 2019-2020 and 2020-2021, whose SPI value was found to be 0.097 and 1.6, respectively. As for the *Artemisia sieberi*- *Zygophyllum eurypterum* community, the years 2019-2020 and 2020-2021 fell under relatively humid and normal classes, respectively, with their SPI values being 1.14 and -0.70, respectively. Moreover, it was found that annual species were eliminated by drought, especially *Salsola richteri* and *Ammothamnus lehmanii* which were affected the most among other species. Accordingly, the production of *Salsola richteri* was reduced from 800 kg/ha to 60 kg/ha and *Ammothamnus lehmanii* was completely dried. However, the results showed that

1. Assistant Prof., Department of Rangeland and Watershed Management and Research Group of Drought and Climate Change, Faculty of Natural Resources and Environment, University of Birjand, Birjand; rostampour@birjand.ac.ir

2. Assistant Prof., Rangeland Research Division, Research Institute of Forests and Rangelands, Agricultural Research Education and Extension Organization (AREEO), Tehran
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canopy cover and density of perennial species were not significantly influenced by drought ($p \geq 0.05$). For instance, *Ammodendrom persicum* and *Stipagrostis pennata*, which had the highest density in this region, were less affected by drought. On the other hand, in the enclosed rangeland, the species diversity of the *Salasola* community was higher in the normal year ($1-D = 0.15$) than in the dry one ($1-D = 0.105$). It was also found that in the *Artemisia sieberi*-*Zygophyllum eurypterum* community, decreased precipitation rate was more influential in reducing forage production than other vegetation properties. In this regard, the production of all plant species was approximately zero in the normal year, with the grazing capacity being impossible to determine.

Discussions and Conclusion: As found by the current study, drought exerted a significantly negative influence on the density, richness, and diversity of species in the *Salsola* community, with species dominance being greater in the dry year than the normal one. Therefore, it appears that compared to the *Artemisia sieberi*-*Zygophyllum eurypterum* community, the *Salsola* community enjoys a higher species diversity.

On the other hand, 2020 and 2021 were determined as the wet and the normal years based on SPI, respectively. However, although 2021 was identified as a normal year, the increased temperature and decreased precipitation rate during the sampling period so negatively affected the vegetation that the year was practically considered a dry year. Moreover, the comparison of the wet and normal years suggested that the density, canopy cover percentage and forage production of annual species had turned to zero throughout the normal year. However, the *Artemisia sieberi*-*Zygophyllum eurypterum* community experienced much worse conditions than the *Salsola* community, where the species richness in both grazing and enclosed rangelands decreased from 25 species to 4 and 7 species, respectively. It was also found that all annuals and herbaceous species had been eliminated from the region and only perennial plants and shrubs had survived. This study examined biodiversity as one of the most important characteristics of plant communities that could be affected by drought, as biodiversity is believed to be involved in improving the performance of natural ecosystems. Furthermore, biodiversity can protect an ecosystem's performance against severe weather events. Considering the response of plant species to drought, *Ammodendrom persicum* is recommended as a drought-resistant plant to be planted in areas that are subject to the programs dedicated to the revival of dry and desert regions. **On the other hand,** being generally defined in terms of different aspects, drought is classified into various types, including meteorological, hydrological, agricultural, economic, and social. In this regard, ecological drought is also recommended to be added to such a classification.

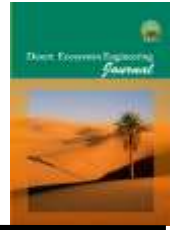
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