



Assessing and Predicting the Vulnerability to Agrometeorological Drought Using the Fuzzy-AHP and Second-order Markov Chain techniques

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Abstract

Vulnerabilities of different regions to drought are under the influence of different factors such as the land use, accessibility to the surface and subsurface water resources, etc. In this research, using the information of 18 effective indicators on the region's vulnerability to agrometeorological drought, the vulnerability of Fars province to agrometeorological drought was assessed and predicted. For this purpose, first, a drought vulnerability map for each of the indicators for 2000, 2005, 2010, 2015, and 2020 years was prepared (all indicators were classified into mild (Mi), moderate (Mo), severe (Se), and very severe (VSe) classes). Then the weight of each indicator was determined using the Fuzzy-AHP method. In the next step, by superposition the criteria's maps based on their weight, the final vulnerability maps to drought were prepared for the years mentioned above. Finally, using the second-order Markov chain method, the vulnerability class to agrometeorological drought was predicted for each pixel (34,200 pixels) over the Fars province for 2025 and 2030. The results indicated that the ratio of rain-fed cultivated area to total agricultural lands (0.215) and slope (0.009) had the highest and lowest weights. The study area in all years was classified into Mo (east and northern regions) and Se (west and southern regions) vulnerability classes. Based on the Spearman test, from 2000 to 2020, the area percent of the Mo and Se classes of vulnerability had a decreasing and increasing trend, respectively. The validation test of the second-order Markov chain showed that this model has 92% accuracy for predicting the vulnerability classes. Also, in 2025 and 2030, the area percentage of the Mo class will be equal to 57.17% and 57.30% of the study area, and the area percentage of the Se class will be equal to 42.83% and 42.70%.

Keywords Agrometeorological Drought · Vulnerability · Prediction · Markov chain · Fuzzy-AHP

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