**Agricultural vulnerability assessment of Gilan Province using Climatic Vulnerability index CVI**

Zahra Kazemnezhad: Ph.D. student of Climatology, Islamic Azad University, Science and Research Branch, Tehran, Iran

Manouchehr Farajzadeh ASL: Professor of Geography Department, Tarbiat Modarres University, Tehran, Iran

Reza Borna: Associate Professor of Geography Department, Islamic Azad University, Science and Research Branch, Tehran, Iran

Abstract

Climate change in one area has severe impacts on water resources and, consequently, agriculture in that area. Climate change causes changes in precipitation and these changes can affect plant performance. Therefore, studying the extent of the vulnerability of regions to adopting policies to reduce or adapt to new conditions is of particular importance. Because climate change has an increasing and a society with low adaptability and vulnerability is more prone to more damage. One of the methods for assessing the extent of damage to agricultural activities is the calculation of the vulnerability index. In this study, the CVI index was calculated for 16 cities in Guilan province, with the aim of assessing agricultural vulnerability to climate change. This indicator shows the characteristics of the region that are affected by climate change.

This index reflects the physical consequences of climate change that affects the well-being and community activity. Guilan province consists of 16 cities and with having various capabilities and potentials in areas such as fertile plains is one of the most important agricultural areas in Iran.

The main question of the present research is that Gilan cities show different agricultural vulnerabilities to climate change. In this study, according to the world-wide studies on climate vulnerability in agriculture caused by climate change, seven components of agricultural vulnerability were identified then, the variables of each of these components were examined. Finally, a conceptual model for agricultural climate vulnerability assessment was developed for this method.

The rainfall and temperature data were collected from the Meteorological Organization and Regional Water Organization of Guilan province during the twenty years (1997-2016). Other data were also obtained from the National Center of Statistics website, the site of the program and budget of Guilan Province and the Agriculture Jihad Organization. In this study, statistical analyzes were performed using Spss and Excell software. ArcGIS software was used separately to map each component of the agricultural vulnerability index. Finally, using this software, the dispersion map of the results of calculating the agricultural climate vulnerability index of Guilan Province (CVI) was prepared.

In final map, 16 cities in Guilan province are classified into five categories in terms of vulnerability without vulnerability (0-29 / 51), Low vulnerability (29 / 52-37 / 08), Moderate vulnerability (49-49 / 37), High vulnerability (49 / 95-55 / 21), and very high vulnerability (55 / 22-100). The results showed that the cities of Rasht (61.58) and Talesh (55.21) had the highest vulnerability and, accordingly, had the least adaptability to climate change compared to other cities. And Langrood city (29.51) has the lowest vulnerabilities. The average value of the calculated index is 40.42 in Guilan province. In component Resource (R), the most vulnerable were Talesh (99.66) and lowest for Lahijan (2.27), In component Meteorological (M), the highest vulnerability was for Rudbar (97.21) and the lowest for Talesh (24.30), In component **Access** (A), the most vulnerable were Rasht (89.99) and the lowest for Anzali (2.21), In component Capacity (C), the most vulnerable were Shaft (66.66) and lowest for Anzali (1.89), In component Use and economic productivity (U), the most vulnerable were Rasht (67.55) and the lowest for Astara (28.92), In component Environmental maintain integrity (E), the highest vulnerability was for Talesh (76.49) and lowest for Lahijan (22.69), In component Geographical (G), the most vulnerable was reported to Rasht (53.05) and the lowest vulnerability was reported for Siahkal (23.24). The highest percentage of drought, the highest percentage of groundwater evacuation, high percentage of arable land, high percentage of employees in the agricultural sector are considered as the main reasons for the increase of vulnerability. On the other hand, having adaptive capacity and high education level is considered as the best reason for low relative vulnerability.

In this research, the most frequent occurrence of drought, the highest amount of groundwater depletion, high groundwater level, increasing the number of employees in the agricultural sector, are the main reasons for the increase in vulnerability. On the other hand, adaptive capacity, high education level is considered as the best reason for low relative vulnerability.

Key words: Gilan, Vulnerability Index, CVI, Agriculture, Climate Change.