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The Relationship Between the Water Stress, Population Growth, Industrialization, and Agricultural Land in China: Evidence from an ARDL Approach**Withanage, D.K.Y.* , Jayasekara, K.D.De S., Gunawardena, U.A.D.P.***Resource Economics Unit, Department of Forestry and Environmental Science,
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*withanageyashodya2000@gmail.com***Abstract**

Water stress has been a global environmental and socio-economic concern, which is especially considered a pressing issue in China for more than two decades. While historical water stress was mostly caused by natural climate variability, recent trends reveal that economic and demographic factors increasingly outweigh natural drivers. However, there have been a limited number of studies focusing on the dynamic short-run and long-run impacts of economic and demographic factors. Therefore, this study intends to evaluate how the total population, Gross Domestic Product (GDP) related to the industrial sector and cultivated area as a percentage of total country area, affects water stress in China in the short-run and long-run. Annual data related to these variables from 1980 to 2022 were obtained from the database of the Food and Agriculture Organization of the United Nations. The Autoregressive Distributed Lag (ARDL) approach was employed for the data analysis, and the Granger Causality test was also used. The ARDL (4,6,6,5) model was estimated using the EViews software package. As revealed by the results of the ARDL Bounds test, cointegration exists between water stress, population, industrial sector GDP and cultivated area. The model satisfies all the requirements related to diagnostic tests, including tests for serial correlation, the Jarque-Bera test for normality, and the Breusch-Pagan-Godfrey test for heteroscedasticity. Stability of the model was confirmed by the results of the CUSUM and CUSUM of Squares tests. In the long-run, lag values of population, industrial sector GDP and the cultivated area positively and significantly influence the water stress. There is an impact from these variables in the short-run as well. The coefficient of the Error Correction Term (ECT) is negative and statistically significant, and approximately 85.15% of the discrepancy between long-term and short-term water stress levels is corrected within a year. The results of the Granger Causality test found the existence of unidirectional causality from cultivated area as a percentage of total country area to water stress ($F=3.21$, $p<0.05$). Overall, the findings of the study reveal that the water stress is exacerbated by population growth, industrial activity and agricultural land expansion via the increased water demand. These outcomes emphasize the importance of integrated water management policies that improve industrial water efficiency, promote sustainable agricultural practices, and effectively manage the water demand to ensure water security, while maintaining a balance between economic growth and environmental protection in China.

Keywords: *ARDL approach, Cointegration, Water stress, Population, Cultivated area, Industrial sector GDP*