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Investigating Impacts of Climate Change and War on the Green Cover Area in Northeast Syria Between 2000 and 2023

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During the 20th century and continuing into the present, significant warming was observed due to the emission of greenhouse gases, primarily CO_2 and CH_4, into the atmosphere. The sixth assessment report of the Intergovernmental Panel on Climate Change estimates a warming of 1.1°C above 1850-1900 in 2011-2020. As climate warming continues to reshape atmospheric conditions and trigger extreme weather events such as drought, forest fires, and floods. The intricate relationship between these changes and vegetation dynamics becomes increasingly evident, profoundly affecting ecological systems, agriculture, and politics. Vegetation is an essential component in ecological systems since it serves as a connection between soil, atmosphere, and water; and plays a crucial role in maintaining the balance of carbon and water, facilitating the exchange of materials and energy, ensuring climate stability, and reducing greenhouse gas emissions. Generally, changes in vegetation are analyzed to assess the environmental conditions at both regional and global levels. The normalized difference vegetation index (NDVI) is a commonly employed tool for analyzing variations in vegetation dynamics. Examining these changes and their triggers is crucial for comprehending the relationships between vegetation and ecosystems. Syria, located at the intersection of Asia and the Mediterranean, is an area with a high level of water scarcity and is susceptible to extreme droughts, especially in the northeastern region, where temperature and evaporation have significant impacts. The land cover in the northeastern region has undergone significant alterations in recent decades due to the armed conflict, which its effects on the land use and land cover (LULC) are neither unidirectional nor spatially uniform. Research and policy alike have given careful consideration to the relationship between conflict and climate change. Extreme weather events, like droughts, have been shown to correspond with the start of armed conflicts occasionally. The most widely proposed mechanism between climate change and violent conflict is the relationship between shocks to agricultural productivity and the degradation of vegetation. In this study, the ERA5-Land data has been used to analyze the climatic conditions in northeast Syria between 2000 and 2023. In addition, the satellite images of Landsat 5, 7, 8, and 9 have been used to generate NDVI maps. Then, a correlation between the meteorological parameters and the NDVI was established to examine how climate change and drought have affected the green cover in the study area, especially after 2011, when the armed conflict started. Meteorological parameters

such as temperature, soil temperature, precipitation, and evaporation on an hourly scale have been applied. The drought events have been addressed by the number of precipitation events, precipitation accumulation, and precipitation intensity. Moreover, the Standardized Precipitation Index (SPI), which is considered as a global standard for evaluating the severity of drought, has also been used for various time scales (3, 6, 9, and 12 months). The study highlighted how climate change had affected the vegetation areas in the northeastern region of Syria. The results emphasized different drought events and mapped the change in the LULC through the time period of the study.