DROUGHT ASSESSMENT IN THE PHILIPPINES USING ENHANCED VEGETATION INDEX (EVI) BASED AGRICULTURAL DROUGHT INDICES

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ABSTRACT

Agricultural drought is a significant hydrometeorological hazard characterized by prolonged soil moisture deficits due to insufficient rainfall, severely affecting crop growth and yield. This is particularly critical for agricultural economies such as the Philippines. In this study, we assessed agricultural drought in the Philippines using Standardized Vegetation and Temperature Ratio (SVTRe) and Vegetation Health Index (VHIe) based on Enhanced Vegetation Index (EVI) from MODIS satellite data (2000–2024).

We conducted drought characterization analysis using run theory, a statistical method for finding consecutive dry periods and quantifying their frequency, duration, and intensity. Cagayan Valley, Western Luzon, Western Visayas, and western Mindanao were identified as drought-prone regions. SVTRe detected 15–20 drought events and VHIe captured 15–30 events. Both indices captured similar trends in total affected areas. However, SVTRe emphasized moderate droughts while VHIe highlighted more extreme events. Mann-Kendall trend analysis further revealed a gradual increasing trend in drought severity, particularly in Northern Luzon and western parts of the country. Correlation analysis with the Oceanic Niño Index (ONI) showed a low to moderate negative relationship, reinforcing the indices' potential for monitoring El Niño-induced droughts. Correlation between these indices and quarterly rice yield was weak to moderate but statistically significant (0.427 for SVTRe, 0.457 for VHIe), suggesting that higher index values correspond to increased rice production. However, lag correlation analysis (lag = 1 quarter) showed weak associations, likely due to regional planting variations, highlighting the limitations of quarterly data for delayed drought impact assessments.

Lastly, we performed an accuracy assessment using a confusion matrix, based on rice damage reports from the 2018–2019 Weak El Niño. SVTRe demonstrated higher accuracy (58.25%) due to a greater number of true negatives. Yet, it struggled to detect actual drought occurrences, leading to a lower hit rate. Conversely, VHIe had a higher hit rate (90.14%), but had

a high false alarm rate. VHIe can detect more drought-affected areas but also misclassified many areas. These findings suggest that SVTRe is more reliable for distinguishing non-drought conditions, while VHIe is more effective for early drought warnings. Ultimately, both indices provide critical insights into drought characteristics and progression, offering valuable tools for improving agricultural drought monitoring in the Philippines.

Keywords*: agricultural drought, MODIS, EVI, SVTRe, VHIe, drought assessment, drought trend, accuracy assessment*