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Impact of international trade on regional ecosystem sustainability: Evidence from Ukraine amid war

Abstract. The study aims to examine the impact of international trade on the sustainability of regional ecosystems in Ukraine, particularly amid the ongoing Russia-Ukraine war. The paper applies econometric modeling, factor analysis, cluster analysis, and geographic information systems (GIS) for spatial analysis. Sustainability indicators include environmental resilience indicators (carbon emissions, water quality), economic stability metrics (GDP per capita, investment in green technologies), and social sustainability factors (employment rate, access to education and healthcare). Results indicate that a 1% increase in exports enhances sustainability indicators by 0.9%, while a 1% rise in imports or demographic density reduces these indices by 0.94% and 0.75%, respectively.

Cluster analysis identifies five groups of regions with varying ecological resilience, revealing critical vulnerabilities in southern and eastern Ukraine where resilience indices are below 0.5. War actions exacerbate these issues, causing infrastructure destruction, soil and water degradation, and pollutant emissions ranging from 152.5 to 16,311.4 thousand tons. Recommendations include scaling up environmental protection investments by 20% (from the current 5,965–165,228 thousand UAH) and integrating sustainability standards into international trade policies to harmonize economic activities with environmental management in crisis and post-war recovery contexts.

Keywords: ecosystem sustainability, international trade, econometric modeling, cluster analysis, discriminant analysis, geographic information systems