# Diversity and economic potential of home gardens in different agro-ecological zones of Lebanon

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## Abstract

Studies on species distribution across space and time and their underlying drivers has only recently become an important topic in biodiversity research. Understanding these dynamics is fundamental for strategic decision-making and thus relevant in the context of rural-urban transformations. This study investigates the spatial distribution and diversity of tree species within home gardens in three agroecological zones of Lebanon, encompassing six villages. The primary objective of the research is to comprehensively document home gardens and tree species within the study area, with a focus on understanding their diversity levels, the determining factors, and change patterns of land cover. The study applies mixed methods. Using interview data of 20 key informants and 160 semi-structured household questionnaires, we investigated the socioeconomic status of households and the availability of 15 main woody species within their home gardens such as olives, fruit species, and oak varieties. Diversity of home gardens was assessed using the species richness classification and the Simpson Index analysed by Chi-squared tests. We employed a geographically weighted regression (GWR) model using Geographical Information System (GIS) to assess spatial non-stationarity and the relationships between different factors. Relationships such as altitude, slopes, precipitation, land tenure, land use policy, water availability and distance to markets were assessed using GWR regression coefficients. Also, we have mapped of changes in land cover from 1969 to 2023 over time using high resolution classical CORONA (black and white) versus today's Sentinel-2 images. The survey enumerated a total of 13,005 trees across the sampled home gardens. Chi-squared tests of independence reveal a statistically significant associations between species richness and household income and education level with smallholder production, as well as an increased distance from the nearest market. Diversity of trees had a positive spatial autocorrelation and different driving factors in different zones had complex influences on the spatial distribution of trees. Land cover change (with level of accuracy 78 %), demonstrated the relative change in the abundance of trees over time, particularly olives. The data also indicate that tree diversity is vital for stability and sustainability in food security, offering crucial environmental services and maintaining biodiversity.

**Keywords:** Geographically weighted regression model, spatial distribution, tree species