

Tree Diversity in Small-scale Holdings of Lebanon's Agroecological Zones

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Introduction & Methods

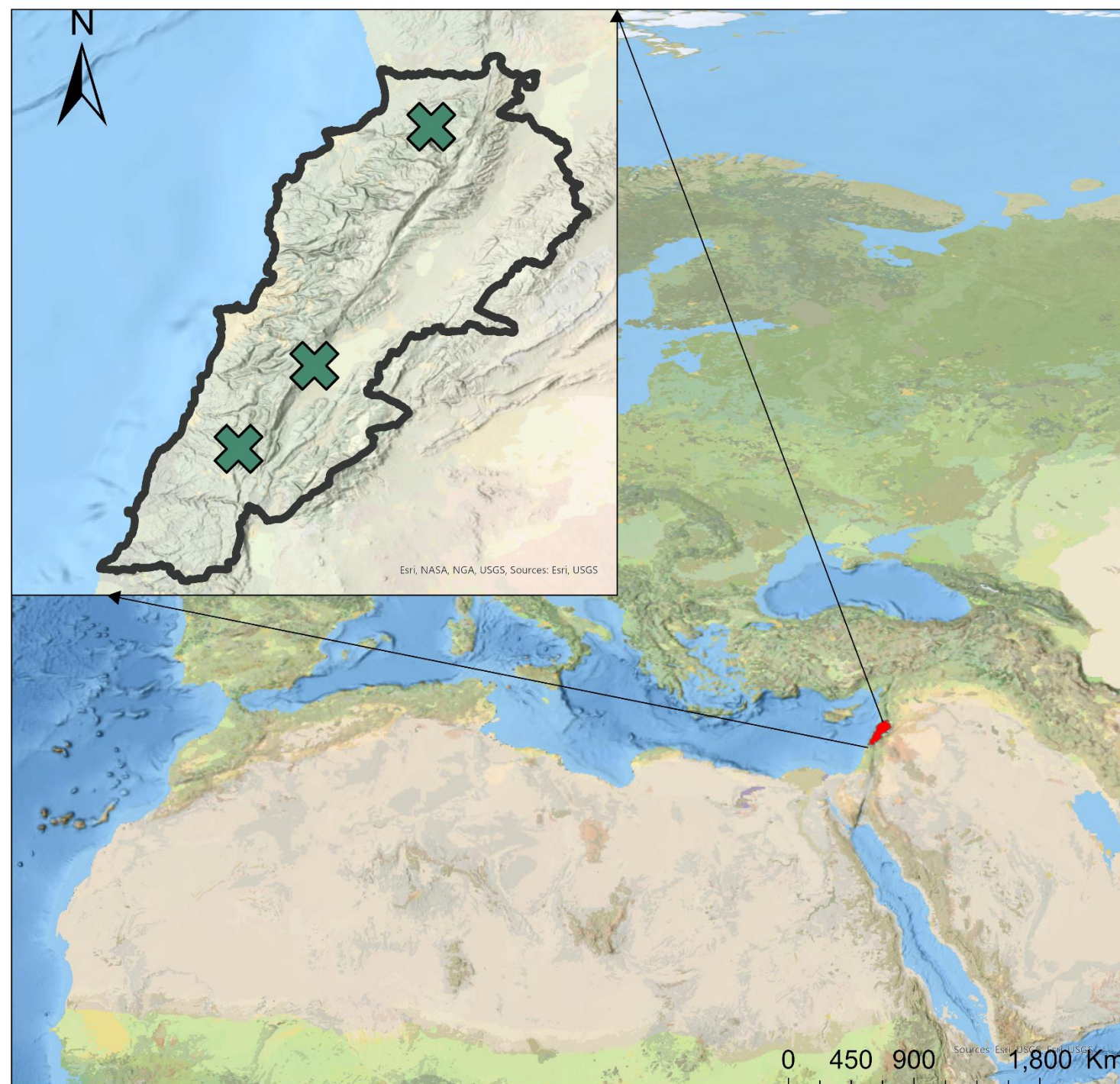


Figure 1. Study areas in three AEZs of Lebanon

Throughout their history Lebanon's landscapes underwent multiple regime shifts leading to major changes in land use land cover (LULC) at different scales. To analyze the factors determining fruit tree diversity, we used high-resolution LULC mapping and interview data from small-holder fruit gardens in six rural villages of the country's different agroecological zones (AEZ; Figs. 1 & 2).

A geographically weighted regression model (GWR) was employed to determine the importance of factors driving tree diversity

$$\gamma = \beta_0(\mu_i, \nu_i) + \sum_{k=1}^n \beta_k(\mu_i, \nu_i) X_{ik} + \varepsilon_i$$

y: (n × 1) Explained variable
xi: (n × k) Explanatory variable matrix
βk (μi, νi): Regression coefficient of factor k
(μi+νi): Longitude and latitude of the ith observation point
εi: Residual

1. Agroecological Setting

2. Land Ownership

3. Proximity

4. Socio-economic

Figure 2. Drivers of LULC change in Lebanon

Results & Discussion

LULC change across six rural landscapes of Lebanon:

- Reduction in natural areas (barren, grassland shrubland) (Fig. 3).
- Expansion of built-up and fruit tree cultivation (Fig 3 & 5).

Effects of rural-urban transformation on farmers' livelihood and land use in the last 10 years:

- 49% of the interviewed farmers reported livelihood diversification (out of 120).
- The proportion of farmer who own land increased with the cultivation of fruit trees (R=0.69; Fig. 4)
- Farmers have planted more fruit trees: 24 ha olives, 15 ha citrus, and 8 ha other fruit trees (Fig. 5).
- Educated farmers tend to diversify fruit trees cultivation

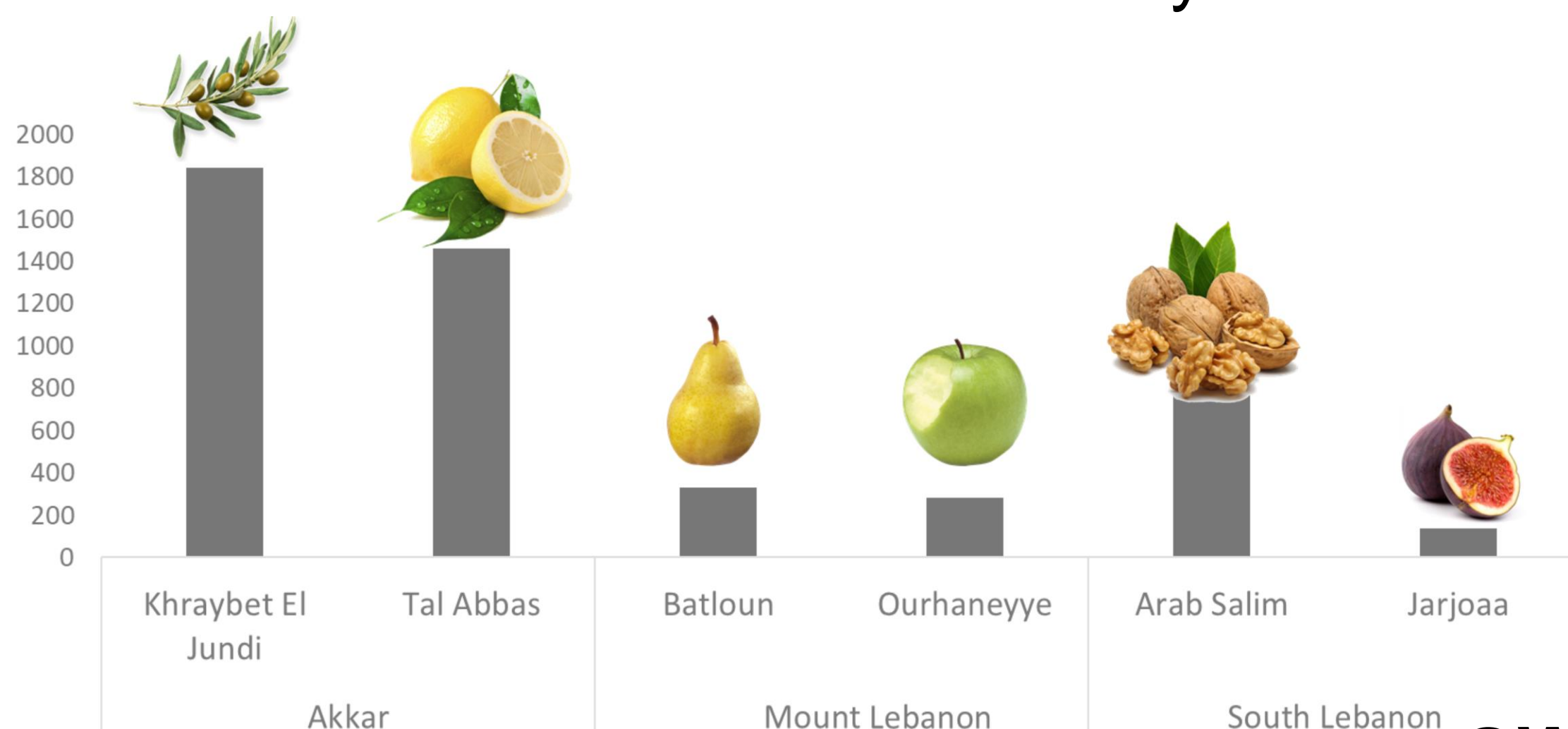


Figure 5. Number of trees in 2023 Photos are licensed under CC-BY-NC



Figure 6. Examples of fruit tree cultivation and diversity

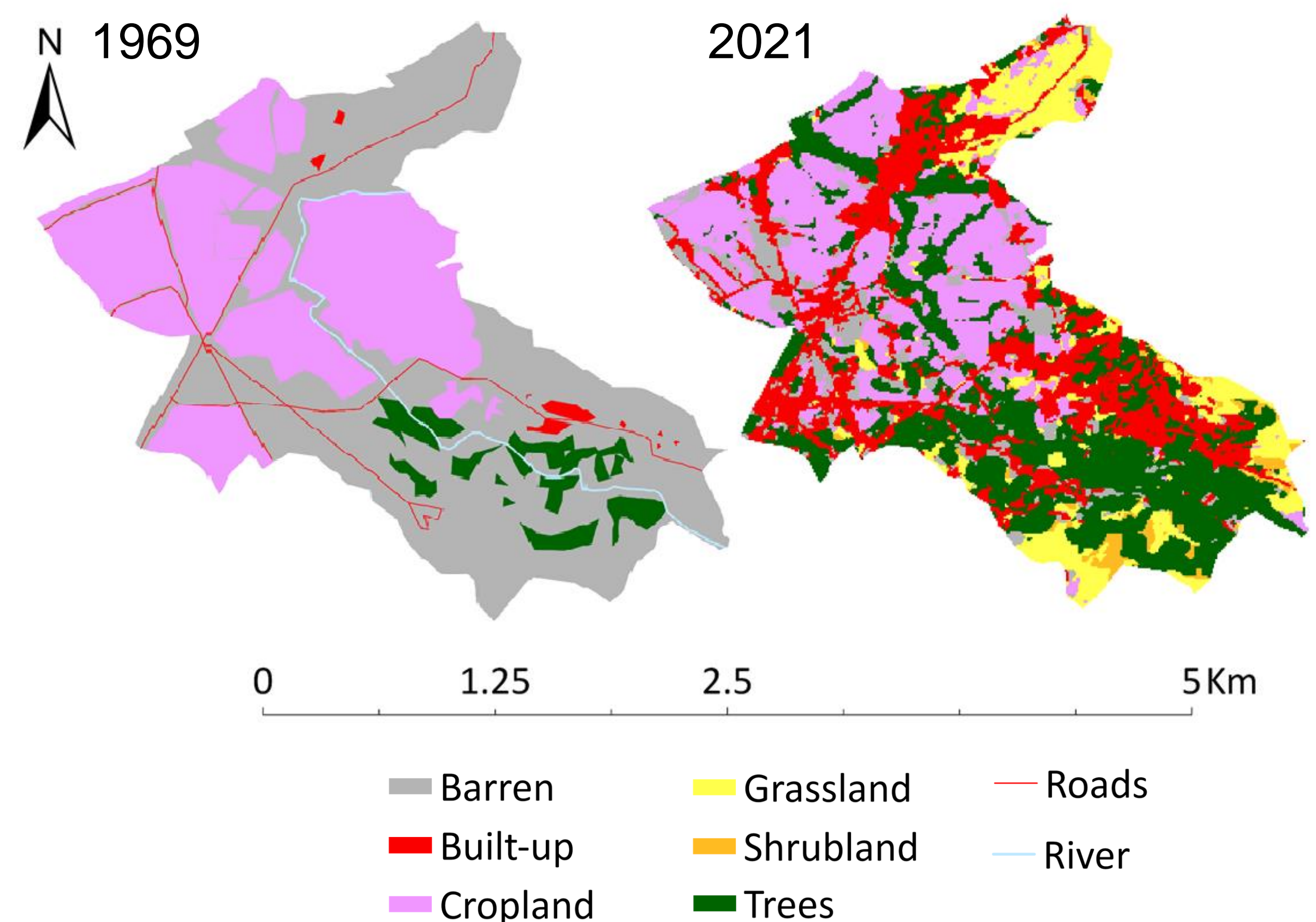


Figure 3. LULC transformation in Khraybet El Jundi (Lebanon)

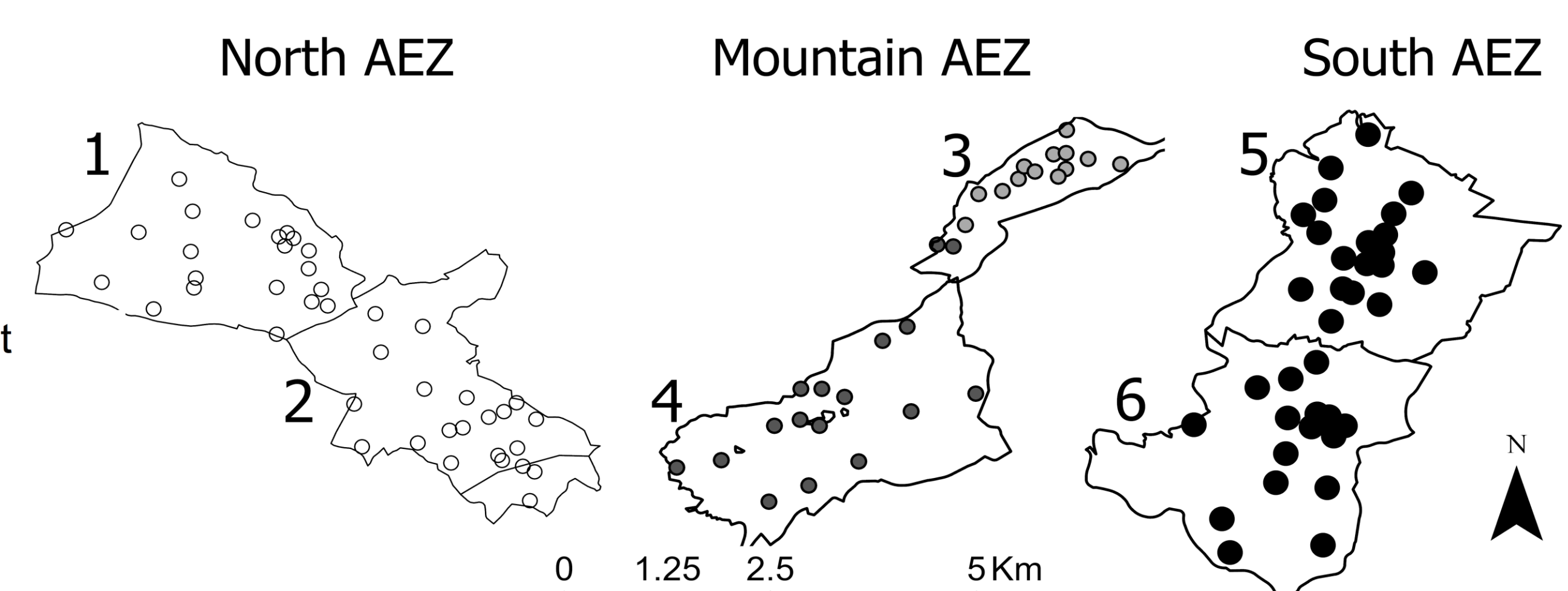


Figure 4. Spatial distribution of regression coefficient of land ownership, numbers represent villages.

GWR shows that the diversity of fruit tree cultivation correlates:

- + with the distance to water resources
- + with land ownership and distance to main roads (proximity)

Opportunities and challenges of fruit trees in rural landscapes

Intensive monocropping poses challenges (reduction in river water quality and groundwater availability, drilling of deep-wells; Fig. 6B & C).

More trees (→ creation of a better microclimate, enhanced wildlife, more wind shields, sequestration of carbon, prevention of soil erosion Fig. 6A).

Conclusions & Recommendations

- Like other countries, Lebanon experiences an expansion of fruit tree cultivation as a consequence of urban growth.
- Effective collaboration between regulatory agencies and law enforcement, effective land management, taxation of water over-use, and support for alternative livelihood strategies are necessary to mitigate negative effects of rural-urban transformation on small-scale farmers' livelihoods and ecosystem services.