

EXPLORING DRIVING FACTORS AFFECTING THE SPATIAL DISTRIBUTION OF FARMHOUSES IN YUANSHAN TOWNSHIP, YILAN COUNTY

Based on a Discrete-Time Hazard Model

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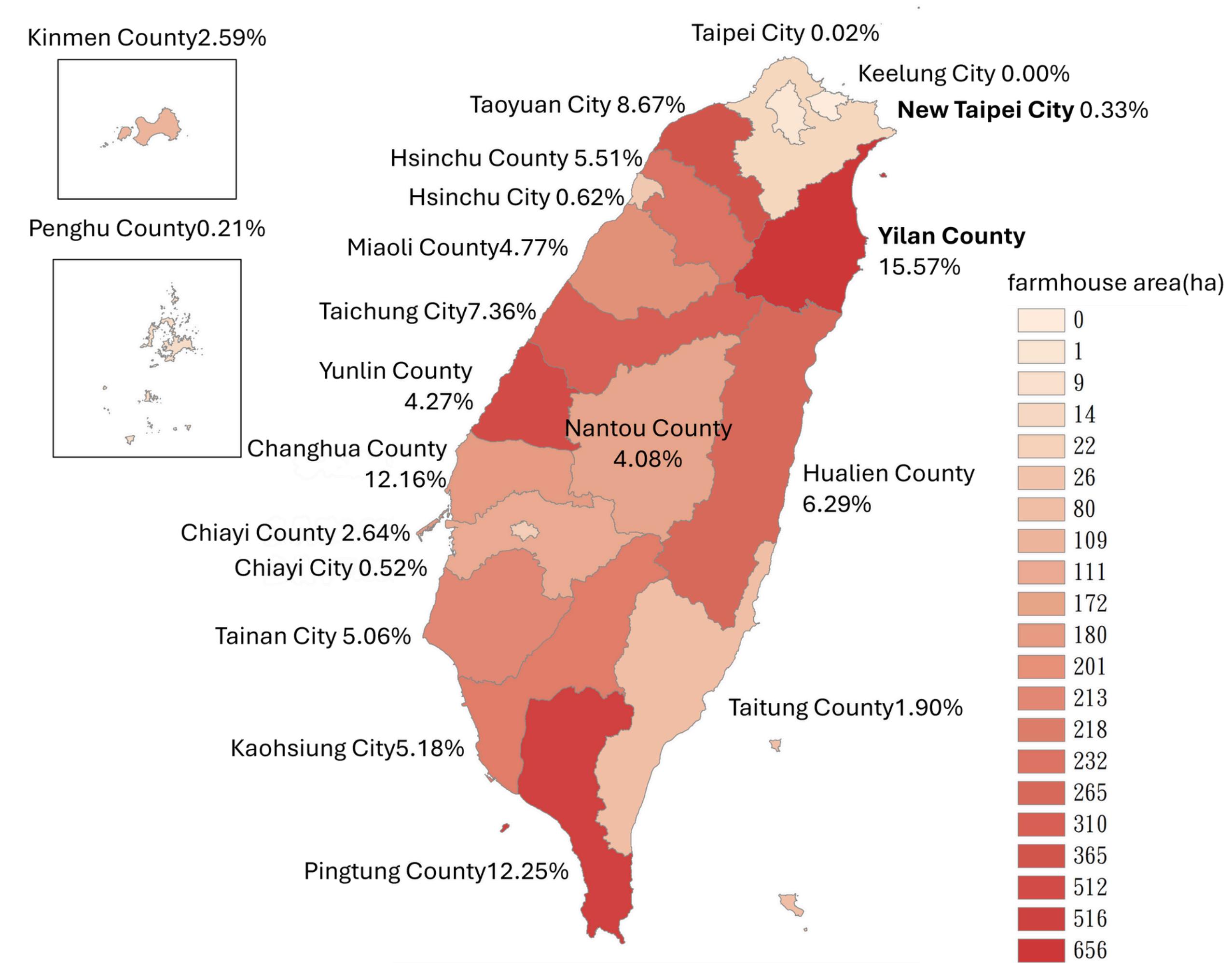
INTRODUCTION

Farmhouse Proliferation Crisis:

Yilan County currently exhibits the highest proportion of farmhouse area in Taiwan (17.85%). Since the amendment to the Agricultural Development Act in 2000, a critical structural deregulation has occurred.

This policy shift decoupled land ownership from farmer status, allowing ostensibly "legal" farmhouses to function as pure residences. This commodification of farmland has bypassed the essence of agricultural land use, leading to the fragmentation of cultivated land.

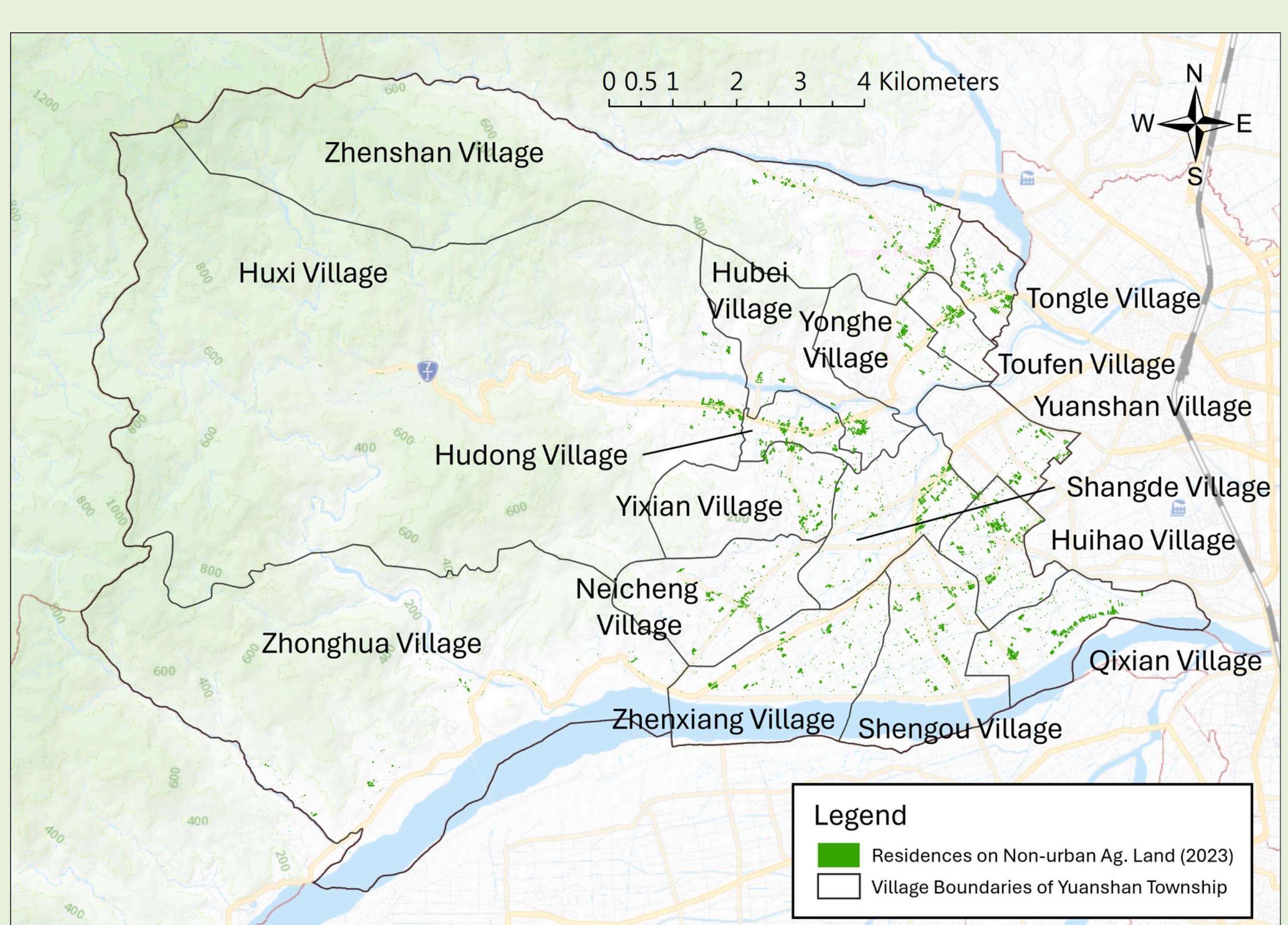
Study Area Justification: Reasons for choosing the study area: Yuanshan Township was chosen because it has the highest farmhouse area in the country (17.85%) and the highest density of non-urban agricultural land used for residential purposes in the county (20.8%).



Township / City	Share of County's Total Ag. Residential Use
Dongshan Township	19.30%
Datong Township	1.60%
Jiaoxi Township	9.80%
Luodong Township	4.80%
Nan'ao Township	0.60%
Sanxing Township	17.90%
Su'ao Township	1.20%
Toucheng Township	2.70%
Wujie Township	7.60%
Yilan City	3.90%
Yuanshan Township	20.80%
Zhuangwei	9.90%

Objective

Spatiotemporal Analysis: The study utilizes a Discrete-Time Hazard Model (DTHM) to identify the driving factors affecting the spatial distribution of farmhouse residences between 2020 and 2023. By analyzing these factors, the research aims to provide a solid policy basis for future farmland management and for addressing the adverse effects of deregulation regarding land conversion.



(Variable)	Estimate	Pr(> z)
Intercept	-55.94	<0.001***
Period	-1.21	<0.001***
Average Crop Price within 50 meters	-67.34	<0.001***
B&B and Hotel Density	-0.0025	0.3822
Industrial Use Area within 1 kilometer	6.939×10^{-10}	0.0016**
Nearest Distance to Industrial Use	-49.09	0.0062**
Population Density	0.0148	<0.001***
Commercial Use Area within 1 kilometer	-18.08	<0.001***
Commercial Use Area Density	-34.88	0.0001***
Cultivated Land Area within 1 kilometer	-30.74	0.0028**
Housing and Land Price	0.0005	0.056
Local Settlement Area Density	3.684×10^{-7}	<0.001***
Nearest Distance to Streams and Rivers	0.0003	<0.001***
Flood Potential Level	-0.0668	<0.001***
Slope Classification	-0.4009	<0.001***
Farmhouse Residence Area Density	1.415×10^{-5}	<0.001***
Distance to Bus Station	-0.0008	<0.001***
Distance to Provincial Highway (including Expressway)	0.0001	<0.001***
Distance to Township Road	-43.23	0.0008***
Road Adjacency	-0.5058	<0.001***
Distance to Bicycle Path	-21.7	<0.001***
Distance to Parks and Green Spaces	1.788×10^{-5}	0.174

METHODOLOGY

Discrete-Time Hazard Model (DTHM) & Variable Selection: The study combines Survival Analysis with Logistic Regression to analyze the hazard rate of land conversion. We initially compiled 26 potential variables across four dimensions: Socioeconomic, Natural, Land Use, and Planning Environment.

To ensure statistical rigor, a Multicollinearity Test was conducted using the Variance Inflation Factor (VIF). Variables exceeding the threshold were excluded to prevent model distortion. Maintaining a strict criterion of $VIF < 5$, 20 independent variables were ultimately selected from the initial pool for the final model.

Category	Key Candidate Variables
Socioeconomic Environment	Average Crop Price within 50 meters, Tourism and Recreation Potential Index, Nearest Distance to Scenic Spots, B&B and Hotel Density, Industrial Use Area within 1 kilometer, Nearest Distance to Industrial Use, Population Density, Commercial Use Area within 1 kilometer, Commercial Use Area Density, Cultivated Land Area within 1 kilometer, Housing and Land Price, Local Settlement Area Density
Natural Environment	Nearest Distance to Streams and Rivers, Flood Potential Level, Slope Classification
Land Use Interaction	Farmhouse Residence Area Density
Planning Environment	Distance to Railway Station, Distance to Bus Station, Distance to National Freeway, Distance to Provincial Highway (including Expressway), Distance to County Road, Distance to Township Road, Road Adjacency, Distance to Bicycle Path, Distance to City Center (Yilan City, Luodong Township), Distance to Township Center, Distance to Parks and Green Spaces, Distance to Leisure Agriculture Area

RESULTS

Market Dynamics (Time Effect): The Time Dummy Variable showed the greatest practical impact, reducing risk by 60.55%.

This significant negative influence confirms a sharp decline in expansion velocity during the study period, likely attributed to a decrease in market investment enthusiasm for farmhouse properties.

Natural & Spatial Constraints: Road Adjacency (-39.70%) and Slope Classification (-33.03%) were the strongest spatial constraints.

Flood Potential Level also reduced risk by 6.46%. These findings reinforce that high development costs and safety concerns in areas with steep slopes or flood risks effectively deter construction.

Socioeconomic Drivers: Population Density was the primary positive driver, increasing risk by 1.48%.

This indicates that areas with higher population density, offering better convenience and amenities, continue to drive conversion pressure for residential use.

DISCUSSION & CONCLUSION

Regulatory Paradox: The strong risk reduction associated with Road Adjacency confirms a shift in development patterns due to regulatory relaxation.

The results suggest that deregulation policies allowing non-adjacent construction have paradoxically shifted development risk away from road-adjacent parcels to agricultural lots that are not directly accessible, creating a new challenge for land management.

Policy Recommendations: Future policies must strictly enforce regulations based on Natural Constraints and revisit the deregulation regarding non-adjacent construction.

The conversion risk is primarily governed by market dynamics and natural limits. Therefore, targeted policies addressing these constraints are essential to preventing further fragmentation of Taiwan's agricultural landscape.