

GIS and remote sensing applied to topographic analyses of hilly and mountainous communities, Nishi-Awa, Japan

*Roxanne Lai¹, Takashi Oguchi¹

1. University of Tokyo

Quantifying topographic characteristics of hilly and mountainous settlements is important to fully understand the drivers of issues such as depopulation, as well as the implications of topographic characteristics in the face of future human development or climate change. These settlements are located on remote and difficult terrain such as steep slopes and thin soils. Consequently, these settlements are particularly vulnerable to environmental and social threats such as landslides from rainstorms, food insecurity, and political marginalization. Mountain topography plays a large role in defining multiple characteristics of hilly and mountainous settlements, and is also therefore important to understand within the context of the sustainability of these settlements.

While topographic studies have been conducted for individual settlements or on large country-scales, few regional studies have focused on the distribution of topographic characteristics across multiple settlements due to difficulties in obtaining multiple accurate settlement-level data. Regional or national-scale topographic studies in Japan tend to apply administrative boundary shapefile data freely offered by the government. However, these boundaries fail to distinguish the much smaller agriculture settlements.

To clarify the differences of using topographical characteristics at different scales (i.e., whether at settlement or at municipal scales) and better characterize hilly and mountainous settlements, this study applies medium-resolution topographic data and geospatial analysis. This study firstly identifies and quantifies the topographic characteristics (slope, profile curvature, elevation, and aspect) of agriculture settlements in the Nishi-Awa area, Shikoku, Japan, and secondly compares their topographical characteristics with the characteristics calculated from government-designated boundaries. Thereafter, correlation calculations are performed using the calculated topographical characteristics and other geographic variables to explore the relationship their relationship with depopulation.

The results show that aspects and profile curvatures of the settlements indicate directional tendencies most likely based on preferential agriculture conditions. Significant heterogeneity of topographical characteristics within the Nishi-Awa administrative area implies governance needs to account for the variety of environmental and social risks occurring. Furthermore, slope angle calculated from broader boundaries tends to overestimate actual mean slope angle of the settlements, resulting in exaggerated relationships between topography and depopulation. However, results also emphasize that even within mountainous settlements, slope remains a major driver of depopulation, compared to other topographical variables. This implies that other factors such as aging population may exacerbate slope influence on depopulation.

Keywords: Topography, GIS, Remote Sensing, Hilly and mountainous communities

