

Multi-Sensor UAV Remote Sensing Workflow for Detecting Buried Archaeological Features at Thermi (Lesvos) and Its Application to Arisvi (Lesvos)

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The study develops a multi-sensor Unmanned Aerial System (UAS) workflow to detect buried architectural remains at the prehistoric site of Thermi (Lesvos, Greece) and evaluates its transferability to the Arisvi region. By integrating high-resolution RGB, multispectral, thermal, and LiDAR datasets, we aim to establish a non-invasive prospection methodology capable of revealing subsurface features in unexplored areas, such as Arisvi in Lesvos.

The case study area was segmented into 5m. × 5m. grids and extracted three datasets: (1) multispectral indices (NDVI, SAVI, GRVI, GNDVI, TBVI) distilled via PCA to emphasize key spectral variations; (2) thermal anomalies identified through z- score normalization; and (3) LiDAR-derived terrain metrics (slope, curvature, hillshade, relief). Statistical screening (normality, rank tests, Spearman correlations) pinpointed which variables diverged most between grids with known buried archaeological features and grids without based on archaeological records from 1930 [1].

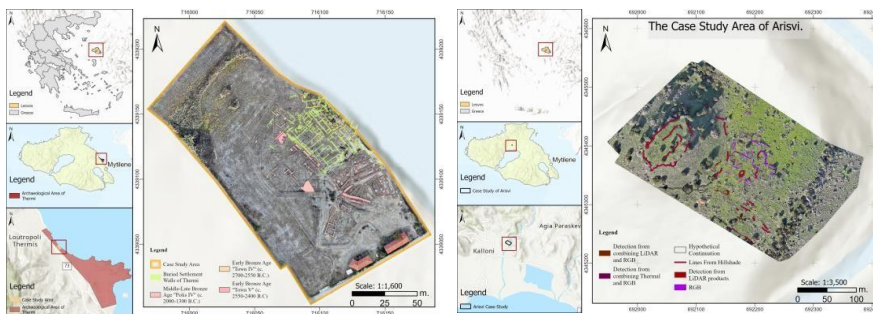


Figure 1. Left: The case Study of Thermi, Lesvos. Right: The Case Study Area of Arisvi, Lesvos.

In logistic models, thermal measures yielded > 95 % accuracy, perfect sensitivity, and 94.5 % specificity, underlining their strong contrast over subsurface features. PCA-combined vegetation indices improved over single indices ($\approx 87\%$ vs. $\approx 82\%$), indicating synergistic spectral signals. LiDAR metrics, though weakly correlated ($\rho < 0.35$), effectively mapped subtle depressions, suggesting their utility as auxiliary predictors in a multi-sensor prospection framework.

The combined UAS workflow therefore provides a powerful, non-invasive approach for subsurface prospection at Thermi and can be seamlessly transferred to Arisvi (Palaiokastros), the latter lacking any systematic survey beyond Koldewey's 19th-century plan [2]. By tailoring flight parameters, sensor setups, and 5 × 5 m grid dimensions to Arisvi's terrain and vegetation, this protocol can swiftly produce spectral, thermal, and microtopographic anomaly maps—delivering the first high-resolution archaeological reconnaissance of an otherwise unexplored site.

References

- [1] W. Lamb and J. K. Brock (1930/31), "Excavations at Thermi," *Annu. Br. Sch. Athens*, vol. 31, pp. 148-165.
- [2] R. Koldewey (1890), *Die antiken Baureste der Insel Lesbos*. Berlin, Germany: Kommissions-Verlag von Georg Reimer, pp. 29-30.