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From Data to Spatial Decisions: A GIS-Based Multi-Criteria Framework for Site Selection and Spatial Evaluation

Spatial decision-making represents one of the core challenges in geosciences and territorial planning, requiring the integration of heterogeneous datasets, expert knowledge, and analytical methodologies. This presentation introduces a comprehensive GIS-based multi-criteria framework that transforms spatial data into informed decisions through systematic analytical procedures. The framework integrates the Analytical Hierarchy Process (AHP) with geospatial modeling, enabling the quantification of factor weights and their spatial overlay to derive suitability and evaluation maps. It ensures consistency, transparency, and reproducibility of decisions by combining objective geospatial parameters with expert-based value judgments. The methodology was validated through multiple case studies involving natural hazard assessment, infrastructure siting, and resource potential evaluation, demonstrating its adaptability across scales and thematic domains. The workflow emphasizes data acquisition, normalization, factor weighting, overlay modeling, and validation through ROC-AUC analysis to assess model performance and decision reliability. Results confirm that the integration of multi-criteria decision analysis within GIS enhances spatial reasoning, supports complex evaluations, and provides a scientifically grounded basis for site selection. The proposed framework contributes to smarter, data-driven, and sustainable spatial decision-making, applicable to diverse planning contexts where competing spatial criteria must be balanced objectively and transparently.

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